THE

EDINBURGH SCHOOL

OF

M E D I C I N E;

CONTAINING THE

PRELIMINARY OR FUNDAMENTAL BRANCHES

OF

PROFESSIONAL EDUCATION;

VIZ.

ANATOMY, MEDICAL CHEMISTRY, AND
BOTANY.

Intended as an

INTRODUCTION TO THE CLINICAL GUIDE

THE WHOLE FORMING A COMPLETE SYSTEM OF MEDICAL
EDUCATION AND PRACTICE ACCORDING TO THE
ARRANGEMENT OF THE EDINBURGH SCHOOL.

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BY WILLIAM NISBET, M.D.

FELLOW OF THE ROYAL COLLEGE OF SURGEONS OF
EDINBURGH, &c.

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IN FOUR VOLUMES.

VOL. II.

THE

ANATOMICAL GUIDE;

OR,

A VIEW

OF THE

ANATOMY AND PHYSIOLOGY

OF THE

HUMAN BODY,

IN THE

SOUND AND MORBID STATE;

WITH THE

APPLICATION OF CHEMISTRY,

AND THE CHIEF MODES OF ANATOMICAL PREPARATION
WHICH HAVE BEEN EMPLOYED IN ORDER TO
FACILITATE THE EXPLANATIONS OF
ITS STRUCTURE.

TO

DR. MATTHEW BAILLIE,

FELLOW OF THE ROYAL COLLEGE OF PHYSICIANS
OF LONDON, F. R. S. &c. &c.

The Anatomical Part of this Work is Inscribed, as a Mark of Professional Respect, and as a proper Return for the many valuable Observations it contains, derived from his Writings ; by

THE AUTHOR.

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DEMONSTRATION

AN

DISSECTIO

I.

FROM the chylopoëtic viscera, our attention
is next directed to those organs which are termed
their assistants. The principal of them is the
liver.

II.

LIVER.

This organ is the largest gland in the body.
It is of a dusky red colour, situated immediately
under the diaphragm, in the right hypochon-
drium, and its bounds are touched by the edge
of the thorax, expanding to the region of the
stomach, and even to the left hypochondrium.
On its upper surface it is convex and smooth,
where opposed to the diaphragm, only flattened on
its left side, where its surface meets the situation

of the heart. On its under fide its furface is
irregular, though at the fame time concave, and
here it is oppofed to the ftomach and inteftines.

III.

Towards the ribs it, is thick, and gradually
becomes thinner as it advances forwards towards
the left fide. On its pofterior edge it is blunt
or obtufe. On its anterior it is fharp or acute,
and from fide to fide its breadth exceeds what it
does from before backwards.

IV.

Lobes.

In entering into a particular defcription of the
liver, the firft parts of it to be demonftrated are
its lobes, and thefe are divided into its great and
fmall ones, which are fo confiderable, as to form
its body and whole upper part. In point of
fituation, the great lobe is placed obliquely in the
right hypochondrium, and follows the curve of
the diaphragm ; while the fmall one, divided by
a broad ligament, is fituated almoft horizontally.

V.

Befides thefe lobes, fome fmaller ones alfo fall
to be noticed, as, 1. The lobe of Spigelius, fituated
on the left fide of the great lobe, near the fpine,
and projecting like a nipple at the fmall curva-
ture of the ftomach: 2. The lobulus caudatus,
angle of the former, fituated at the middle

AND DISSECTION.

of the lower fide of the great lobe : and, 3. The lobulus anonymus, broader, though lefs prominent than the former lobule, and placed between the paffage of the round ligament and the gall bladder.

VI.

Ligaments.

The next parts of this organ are its ligaments, or connecting proceffes, which are chiefly formed from the doubling of the peritonæum.

1. The firft is the fufpenfory one, or broad ligament, placed above between the great and fmall lobes, and extending below into the umbilical fiffure. It is connected obliquely to the diaphragm, and tip of the enfiform cartilage, and afcending in the fame direction, it adheres to the fore part of the fheath of the rectus abdominis mufcle on the right fide.

2. The round ligament, which is the remains of the umbilical vein, placed in a doubling at the under part of the former one, and fixed to the navel.

3. The right lateral ligament, which connects the thick great lobe at its back part with the pofterior part of the diaphragm.

4. The left lateral ligament, longer than the former one, and which ferves for the connection of the left extremity of the fmall lobe to the diaphragm.

b 2

5. To these is commonly added the external coat of the liver, which is merely cellular sub-stance, and unites the root of the liver to the tendinous part of the diaphragm.

VII.

Thus, by the first of these ligaments is the liver preserved in the erect posture. By the second it is prevented, in lying down, from pressing on the diaphragm, so that they both suspend it, and prevent its pressure on the af-cending cava.

VIII.
Fissures.

Next, after the lobes and ligaments of this organ, fall to be demonstrated its fissures or de-pressions, which are chiefly on its under side.

The first is the umbilical fissure between the great and small lobes, and at the under and fore part of the liver. This fissure is of different depth in different bodies, and behind it is com-monly covered with the bridge or isthmus of the liver.

2. The second is the transverse fissure, or sinus portarum, extending from right to left between the great and small lobes, by which its ex-tremities are bounded; and having the lobulus anonymus before, and that of Spigelius behind, the connection of these last forms an appearance

compared to a gate, and therefore diftinguifhed by
the name of porta.

3. The intermediate depreffion for the paffage
of the vena cava, between the great lobe and that
of Spigelius, which has frequently a bridge over
it, forming it into a canal.

4. The depreffion of the ductus venofus run-
ning a little obliquely from the right to the left
fide, and receiving a ligament, part of the umbi-
lical veffels.

IX.

From the peritonæum, this organ derives a coat
which adheres clofely to it, and every where it is
covered by this membrane, except behind, where
cellular fubftance connects it to the diaphragm.

X.

This organ is chiefly compofed of a variety of
veffels, the extreme branches of which are inter-
mixed in fuch a manner, as to form numberlefs
pulpy corpufcules, termed acini, from their re-
femblance to ftones or fmall kernels of fruit; and
thefe again fubjected to examination, appear com-
pofed of veffels in the form of radiated villi.

XI.

From the importance of the liver, its circula-
tion ought to be well underftood. It is in this
vafcular congenies that difeafe is more apt to
form than elfewhere, and it is here the blood

even lofes more of that principle on which its peculiar ftimulus depends.

XII.

The principal artery of the liver is the hepatic, which is fent off from the cæliac at the point of the Spigelian lobe. Its root is covered by the pancreas, and it paffes under the ftomach and duodenum, under the omentum and biliary ducts till it arrives at the porta; and having divided a little before into two branches, thefe enter the great and fmall lobes of the liver. Being inclofed in the paffage into the liver, on the cellular membrane, termed the gliffioris capfule.

XIII.

Before its feparation, this artery in its progrefs gives off branches to different organs as it paffes them. The firft are fmall twigs to the venæ portæ, and to the head of the pancreas, to the large branch termed the arteria duodeno gaftrica, which again foon after its origin feparates into two principal divifions, one of which fupplies the ftomach and omentum, named the gaftro epiploic artery; the other pervades the duodenum, and gives circulation to the pancreas, termed arteria pancreatico duodenalis. Befides thefe larger branches, fmaller arteries alfo arife, one advances to the upper and back part of the duodenum, over the biliary ducts. Next go off fmall arteries

to the duodenum, and alfo to the pancreas. Of thefe deferving notice, is the lower pyloric artery, or branch of the pancreatico duodenalis, fent off as it reaches the duodenum. Others arife at the fame time, which encircle the pylorus, and chufe a direction upwards, in order to inofculate with twigs from the upper pyloric, which comes from the artery of the ftomach.

The next artery, from the fame origin, is a neat fmall branch, named the tranfverfe pancreatic artery, paffing under this organ, and running along its back part. It fends branches into the fubftance of the vifcus from fide to fide, and is exhaufted after pervading $\frac{5}{6}$ of the gland. In its farther courfe along the circle of the duodenum, the arteria pancreatico duodenalis gives off arteries outwards to the duodenum, and inwards to the pancreas, till it ends by an inofculation with the mefenteric artery.

XIV.

When the pancreatico duodenalis paffes down, the other great divifion formerly noticed, paffes up to the ftomach and omentum, named therefore the gaftro epiploic artery. The courfe of this artery is along the lower part of the ftomach, making a broad fweep round its great arch. Branches are diftributed by it in every direction along the organ, and alfo to the omentum. In its progrefs along the ftomach it inofculates with

the splenic artery, and the place of this, from
inspection, is uncertain; and, while the splenic
artery forms the right artery of the ftomach, this
one is properly the left one. Another branch
ftill remains to be noticed, given off by the
hepatic artery, before entering the liver. This
is the

XV.

Pylorica Superior Hepatica,

Which comes off before the hepatic divides,
or immediately after, from its left divifion. I.
returns in a backward direction to the upper arch
of the ftomach, and expanding fome fmall twigs
on the leffer omentum, it paffes directly on to
the pylorus, with whofe upper and lower arteries
it forms inofculations.

XVI.

Hepatica Sinistra.

Within two inches of the liver, the hepatic
artery is divided into two principal branches,
which enter at the porta of the liver, but pafs
the one to the right, the other to the left lobe of
the organ. This branch to the left is fmaller
than the other. It climbs upon the vena portæ,
and enters the liver at the foffa umbilicalis. Its
circulation within the liver is chiefly diftributed
to the left lobe, the lobe of Spigelius, and the
anonymous lobe.

XVII.

Hepatica Dextra.

The right hepatic branch paſſes under the biliary ducts. With them it enters the right lobe of the liver, previous to which it gives off the arteria cyſtica, or branch that ſupplies the circution of the gall bladder. Before conſidering the venous ſyſtem of the liver, it is proper to examine its appendage, or the gall bladder.

XVIII.

Gall Bladder.

It is a ſmall oblique pyriform bag, found on the under ſurface of the liver, half ſunk into the ſubſtance of the blood and nearly horizontal a this organ is found in its place. It is held by the ducts and colon, ſo as to a tinge this ſercetion to theſe parts, and it ſtines a little to the right ſide.

XIX.

This gland poſſeſſes four different coverings, or coats, in the ſame manner as the other bowels. The firſt, or external one, is derived from the peritonæum, and is the ſame that is expanded over the liver. The ſecond is its muſcular coat, which conſiſts rather of a few ſcattered fibres than any regular muſcular ſtructure. The third is a condenſed cellular texture, which is named its nervous coat; and the fourth, or its inner

furface, from its fmall reticular rugæ, or folds, is termed its villous coat. This rugated ftructure is more minute towards its neck than elfewhere, and its folds appear to run in a longitudinal direction. This internal covering is every where perforated by fmall ducts, the excretories of fmall follices, through which a mucus is difcharged to defend the furface from the irritation of the biliary fecretion.

XX.

Through its whole length, the gall bladder is connected by a cellular intermedium to the liver, as well as by its veffels. Its principal veffel, the cyftic artery, already noticed, branches over it betwixt its coats in the form of a coronary artery, and being ramified in a beautiful manner, paffes from it to the liver.

XXI.

The veins of the liver arife from two fources, the vena portæ, and the terminations of its own arteries. The former is fo named from its fituation with refpect to the porta of the liver. It confifts of the veins gathered together from the inteftinal canal, and from the fpleen, and pancreas, and its trunk lies obliquely acrofs the fpine. On entering the liver, it diftributes branches through the fubftance of the organ, and thus, from being derived from two origins, the hepatic veins are exceedingly numerous. The veins from both

origins unite by degrees, and accompany the other veſſels; but, at the root of the liver, they form two or three large trunks, which terminate at the vena cava on its perforation of the diaphragm. Thus the vena porta is a peculiar part in addition to the internal circulation of the liver, being a vein performing the office of an artery, by diſtributing the blood it collects from the arteries of the inteſtines, which blood is intended particularly for the ſecretion of the bile. From the extremities of the porta, therefore, the biliary ducts ariſe by extremely minute branches, termed pori biliarii, or tubuli biliferi, expanded over the ſubſtance of its pulpy corpuſcles. Theſe ducts gradually unite in their progreſs into larger branches, which collect at laſt into two, and run in the end into one, named the ductus hepaticus ſituated in the ſinus portarum.

XXII.

By the ductus hepaticus, the gall, or bile, of a yellow green colour, is conveyed from the liver; and by the appendage of the liver, the gall bladder, or receptacle of the bile, a duct is alſo ſent out, termed the cyſtic. The union of theſe ducts is termed the common one or choledochus, and through it the bile is received from the hepatic duct to be conveyed in part into the cyſtic one, and thus lodged in the gall bladder.

b 6

XXIII.

From confidering the general ftructure and circulation of the liver, we are led to examine its peculiar office of preparing and feparating the bile for the ufe of digeftion ; for, whilft the bile promotes the diffolution and affimilation of the food, it irritates at the fame time the coats of the alimentary canal, and hence, when the flow of it into the gut is any how obftructed, the perfon becomes coftive.

XXIV.

It appears from a variety of circumftances, that the fecretion of the bile is chiefly made from the vena portarum. At firft fight this might be fuppofed from comparing the great fize of the ducts with the arteries, or from having obferved a very fingular connection of veins; the only purpofe of this, that can be reafonably fuppofed, is, that a certain change of the blood, and a certain momentum, different from what is feen in other parts of the body, is neceffary for the parts of the bile ; for what other ufe can be affigned for this fingular courfe of the blood ? But, befides mere probability, it is fully con-firmed by making injections ; and by thofe made from the vena portarum, the fecretion of the bile may be imitated, and pufhed into the biliary ducts ; while, from the biliary ducts, though

it pafles backwards with much more difficulty than forwards, yet it can be made to return.

XXV.

At the fame time, there is reafon to fufpect that a portion of the bile is derived from the hepatic artery; for, when this artery is followed to the liver, we find a branch fent to the gall bladder, called the cyftic artery, and it returns into the vena portarum, not into the vena cava, but all thefe branches fpent upon the liver terminate in the vena cava. Since the conclufion to be drawn is, that the blood returns from the gall bladder into the vena portarum, becaufe no fecretion of bile has been made directly from its branches into the gall bladder, it is not deprived of that fomewhat fit for the formation: but the other branches having furnifhed this fomewhat, return to the heart directly. And to confirm this, on making the fame experiment upon the hepatic artery as upon the vena portarum, there is a fimilar communication, though it is lefs evident; for, upon injecting the artery, the injection gets into the ducts, it is poffible that the liquor may have penetrated into the vena portarum, or the beginning of the vena cava hepatica common to both: but ftill there is a paffage.

XXVI.

Thus the vena portarum chiefly makes the secretion of the bile, and the hepatic artery assists while, perhaps, it performs other offices, by no means understood. Anatomists and physiologists are apt to get into a train of accounting for things without reflection. The hepatic artery has been said as serving to nourish the liver. Now, how does it appear that the vena portarum cannot nourish it? All those that admit of the nourishment being conveyed by arteries, admit that the cœliac and both mesenteric arteries can nourish the stomach, pancreas, guts, and spleen, how is the blood so deprived of nourishing matter that it cannot furnish enough to the liver? It is taken for granted, rather than proved, and we have by no means an absolute proof that it does serve this purpose; only from comparing the heart, lungs, &c. we find that blood, by having undergone one circulation, is deprived of somewhat material to us. Thus however great the quantity, that the whole mass in the lungs is not sufficient to perform certain purposes, unless somewhat is added by the bronchial artery, so that the hepatic artery may serve similar purposes to the liver, and one of these may be nutrition : but we do not prove this with certainty, far less that it is the only purpose.

XXVII.

From the fecretion within the liver, it falls next to be determined whence the bile in the gall bladder is furnifhed. It is commonly taught, that the gall -bladder receives its bile from the liver through the hepatic, and afterwards through the cyftic duct, *i. e.* it defcends by the hepatic duct, meets with more refiftance in paffing into the duodenum, in the empty ftate of the gall bladder, than to its regurgitation into the bladder. So, where there is any confiderable refiftance by aliment or wind within the duodenum, and the gall bladder is not fully diftended, the bile paffes upwards, to be lodged there for a certain time, and after remaining there it is pufhed down, either by the preffure of the ftomach, or action of the external parts of the diaphragm and abdominal mufcles, or by a fupppfed action of its own coats, through the cyftic and through the common duct into the cavity of the inteftines; or that the cyftic and hepatic bile have the fame origin, and only differ in confiftence, for by the ftagnation, changes are made, the thinner parts are taken away by the abforbent veffels; but there may be, befides, other changes made in confequence of the ftagnation, inteftine changes which we cannot fo clearly point out.

XXVIII.

Another opinion fuppofes, that either the coats of the gall bladder furnifhed the cyftic bile, or that the gall bladder receives it by particular fmall ducts opening directly into it. This opinion was fuggefted by Dr. Albinus, that the cyftic bile was derived from the coats of the bladder; and he has mentioned feveral circumftances that feem, at firft fight, to prove it. Thus, upon the inner part of the gall bladder, when flit open, we find minute follicles, which are fuppofed to contain the bile, and that in them it acquires its toughnefs and greater vifcidity, juft as in the throat and ali-mentary canal, the mucus is infpiffated. A very great difference is alfo obfcrved in many animals, in their confiftence and properties, as in birds, where the bile of the liver has a fweet tafte, while that in the bladder is intenfely bitter, fo that there feems fome very effential difference; and it is farther found, that the cyftic and hepatic ducts run parallel to each other, and open feparately into the cavity of the inteftines, which is likewife a fact, without any communication in their courfe downwards. Befides this, cafes are defcribed where the cyftic duct was found obftructed by calculi, and yet a confiderable quantity of bile was found diftending the gall bladder.

XXIX.

Now to shew that, with all thefe appearances of probability, this notion is deftitute of foundation, it may be obferved that thefe follicles are indeed in the gall bladder, but they are alfo every where in the other ducts, and they are particularly numerous in the ductus communis; and when we examine the contents, we find a clear mucous matter within the follicles. So that they are merely intended for a defence againft an acrid matter, juft as the bladder is covered with a quantity of flime, which, in fome difeafes, is difcharged in great abundance. With regard to the two, they agree in colour; and, by infpiffating the hepatic bile, we imitate the cyftic. So that all the changes may be accounted for from the effect of ftagnation and abforption.

XXX.

With regard to birds, upon blowing into the hepatic duct upwards towards the liver, we inflate the gall bladder, there are large branches fent off to the gall bladder, there are hepato-cyftic ducts from the branches of the hepatic ducts. And where the gall bladder has been diftended with bile, and yet a ftone found, the ftone has been moveable, and the bile paffed the fides of the ftone; and the ftone being preffed down into the duct, acted as a valve, juft as a cork within a bottle ftops the liquor before it is

poured out of it : and a vaſt number of cafes can be pointed out, where the cyſtic duct being totally obſtructed, by a ſtone immediately put into it, the gall bladder was found empty, the ſides almoſt contiguous and quite flaccid ; and a ſingle inſtance of this kind is deciſive, becauſe, were the opinion juſt in conſequence of the impaction, the bladder ſhould neceſſarily be found diſtended with bile ; and, upon tying the cyſtic duct after 20 or 30 hours, it has been found more empty than at the time of the experiment.

XXXI.

The ſame arguments refute another ſuppoſition, the applying to men the analogy of birds or the having the hepato-cyſtic-ducts, whilſt it is admitted that ſome portion of the bile may come through the cyſtic duct, it is alleged that a principal ſupply is from the liver directly into it ; and ſome have pretended to deſcribe theſe ducts, and probably from what ſeemed a real obſervation, for conſiderable branches of the hepatic duct run about the gall bladder, which are more ſuperficial in that place than in any other, the gall bladder ſerving as a defence to the ducts. But wherever we find ſuch ducts, there is no communication between the trunks ; the hepato-cyſtic ducts ſerve the purpoſe of this joining ; and where theſe are found, there may be ſome further communication.

XXXII.

But to refute such opinions by direct facts, the hepatic duct may be injected without a drop entering the gall bladder; and the gall bladder may be opened, cleaned in its inner coat, and the liver then squeezed without finding a drop poured out; and when the cystic duct is completely stopped, or tied, the gall bladder remains empty. So we may confider it as a point eftablished in phyfiology, that the bile defcends from the liver by the hepatic duct, and paffes by the cystic into the gall bladder, and returns again through the fame channel. And there is no improbability in the flow being different at different times.

XXXIII.

Chemical Analyfis of the Liver.

The fecretion of the liver, or the bile, is one of the moft important in the animal fystem, and it is of two kinds, the hepatic and cyftic, or that forced directly from the organ into the duodenum, and that which paffes into the gall bladder, and is there allowed to accumulate.

1. The hepatic bile is thin, of a faint yellow colour, inodorous, and but flightly bitter, as is perceptible on eating the liver of animals.

2. The cyftic bile is thick, of a deeper colour, more acrid, and bitter to the tafte.

3. The proper colour of the bile is a yellowifh green, of a foapy or oily confiftence, refembling in its frothi-

nefs, on agitation, a folution of foap and water. In its
tafte it is lefs bitter than that of animals.

4. The principles of the bile deteßed by chemiftry,
confift of,

  a. Water, in a great proportion.

  b. Albumen, as precipitated by alcohol and mineral
acids.

  c. Refin, as deteßed by the folution of bile, and its
evaporation.

  d. A colouring principle contained in the refin.

  e. Soda, in a cauftic ftate, forming neutral falts,
with acids.

  f. Phofphorated calx, with a fmall portion of iron
and culinary falt.

5. The bile has been confidered as an animal foap,
yet it differs from it in fome leading particulars, for
it neither diffolves oil, nor mixes with water like foap.

6. Bile is very fubjeß to putrefaßion, unlefs reduced
to the ftate of an extraß.

7. This fecretion has been confidered as the blood
deprived of its oxygen, and it is confirmed by an ex-
periment of coagulating two parts of blood with one
of diftilled water by fire, when the filtered liquor re-
fembles bile; and the fame effeß follows the boiling
of blood with fuming fpirit of nitre, inftead of water.

8. The primary ufe of the bile feems, 1. The ex-
trication of chyle from the chyme, as fent into the duo-
denum. 2. The exciting the periftaltic motion of the
inteftines. 3. Imparting the yellow colour to the
faeces; and 4. Preventing accumulation of mucus, and
difengaged acid in the primæ viæ.

Anatomical Preparation of the Liver.

A corroded preparation of the liver is the beft mode of fhewing its ftructure; and, in order to do it completely, it requires four pipes, and as many different coloured injections. The veffels by which this organ are injected, are the hepatic artery coming off from the cæliac, the vena portarum, the vena cava afcendens, and the hepatic duct, through which the bile is conveyed. The vena cava on the fuperior furface of the liver, fhould be fecured by a ligature after the blood is wafhed out as clean as poffible. The injection is then to be made in the ufual manner, and when finifhed, the pipes are to be removed, and the liver put into the acid liquor for corrofion before the injection becomes cold and brittle, and it fhould never be handled till it is perfectly corroded, Then let it be wafhed clean, and when dry, varnifhed.

XXXIV.
Spleen.

After the liver, the next organ that falls to be examined is the fpleen; which is a foft vafcular body, of a purple colour. In its fhape it is long and oval, of a confiderable fize, and occupying a fpace immediately under the diaphragm, or the left fide of the ftomach near the ribs, and above the left kidney.

XXXV.

The fituation of the fpleen, however, is fubject to fome variety from two circumftances, the ftate of refpiration, and the dilatation or empti-

nefs of the ftomach; for it rifes or falls with the dilatation of the lungs, and its obliquity is greater or lefs according to the diftenfion of the ftomach.

XXXVI.

The external furface of this organ is convex and uniform, correfponding to the furface of the ribs, to which it is oppofed; while internally towards the fpine, it is irregularly concave. In fize, the fpleen is about 5 or 6 inches long, 3 broad, and 1 thick. Its anterior part is more concave than the pofterior one, and anfwers to the convexity of the ftomach. Deep fiffures are obfervable in different parts of its edges, and it is not uncommon to have a fmaller fpleen connected with the large one.

XXXVII.

The connections of the fpleen are numerous. Below, it is fixed to the omentum, and the omentum and blood veffels join it again to the ftomach. Behind, it is connected above to the diaphragm; and below, through the intervention of the peritonæum and intermediate cellular membrane to the left kidney and colon.

XXXVIII.

The fubftance of this organ is uncommonly foft, and by far the moft tender of the abdominal bowels. It poffeffes two layers or coverings, one the peritonæal coat, the other proper to itfelf, but

clofely joined to the former covering. When the fubftance of the organ is examined, it feems a congeries of vafcular parts united by cellular matter, and the extremities of its veffels terminate in penicelli or fmall brufhes, fomewhat fimilar in appearance to glands. So delicate is the ftructure of its veffels, that any injection of it made, is found to extravafate into its cellular membrane, and to give its ftructure a follicular appearance.

XXXIX.

In proportion to its fize, the veffels of the fpleen are larger than thofe of any other organ. Its artery is a principal branch of the cæliac, and is one of the moft remarkable in the body. It is as large as a goofe quill. It proceeds from the cæliac trunk at right angles, and runs a foot in length acrofs to reach the fpleen. In this courfe it obferves a ferpentine direction; and, after fending off branches to the pancreas, and the arteriæ breves to the left end of the ftomach, it goes into the fubftance of the fpleen, dividing into a great many branches which enter by the concave furface of the organ, and plunge deep into its fubftance.

XL.

The firft of the branches of the fplenic artery thus defcribed, is the pancreatica magna, which paffes to the right under the pancreas, and belongs chiefly to its rounded end, under the duodenum.

2. By the border of the pancreas to the left
it sends alfo short branches into that organ.

3. Next, its branches afcend to the back part
of the ftomach, and its very large and principal
one, is the gaftroepiploic artery. It arifes under the
ftomach, beyond the head of the pancreas, makes
a ferpentine arch, turning upon the ftomach, and
fending branches up to it, and down upon the
omentum.

4. Laft of all, the vafa brevia are given off to
the ftomach before it enters the fpleen.

XLI.

The fplenic artery then entering the fpleen, is
fubdivided into branches, which are crowded
together, and run in every direction, forming at
length plexus or penicelli, which terminate in the
branches of the correfponding vein. This vein
is larger in proportion than the artery. It is
much ramified, and carried through the whole of
the organ. It receives the blood without the
intervention of cells, and into it flow the contents
of the vena brevis, of the ftomach, veins of the
pancreas, &c. fo that it forms a chief branch of
the vena portæ.

XLII.

From the fpleen, no excretory duct has been
found to proceed, which has rendered the ufe of
this organ ambiguous. It appears, however, from

the termination of its veſſels on the vena portæ, that it has a connection with the ſecretion of the liver, and that it diſpoſes the blood collected in the vena portæ, to be more eaſily formed into that ſecretion.

XLIII.

The ſpleen thus appears like a clot of blood incloſed in a membrane of no greater thickneſs or toughneſs. We find arteries in great number conveying a great proportion of blood into the ſubſtance of it, and there divided into very minute branches. In like manner, there are a number of very minute branches of veins, joining together to form larger veins, and forming a trunk, terminating in the vena portarum. In the human body there is no intervention of cells, which are only ſeen when an injection is thrown in with too great force, in which caſe there is an extravaſation into the cellular membrane. Neither do we obſerve knots that may be called glandulæ, or any ducts or hollow tubes ſent out, except the red veins and common lymphatic veſſels.

XLIV.

What account, therefore, is to be given of the ſpleen? This may be judged of from the want of particular ducts, that we can only form con-

jectures about it; and the variety of opinions ad-
vanced, plainly prove the uncertainty of all of
them; and indeed most of them are such as
scarcely merit attention.

XLV.

A late opinion concerning the spleen forming
the red part of the blood, cannot even be except-
ed; so that there is nothing fixed or determined
concerning the use of the spleen, further than a
general presumption that it is subservient to the
liver. For let us see what kind of notion we can
have of the spleen forming the red part of the
blood. We observe a very great quantity of red
blood entering the spleen: Surely that can be
no·argument for its forming the blood? It is
formed before it enters; and the only foundation
for the opinion is, that red particles are observable
in the lymphatic vessels, when these are tied up.
But the spleen has been cut from animals, they
have survived the operation, days, months, and
years, and the colour of the blood has remained
all the while the same, How is this to be
explained? That the lymphatic vessels of the
spleen chiefly convey the red parts, but that the
whole lymphatic system contributes in the same
office. So far such an hypothesis may be com-
mended as serving for a retreat, but what are

we to think of it? That the veffels by nature
intended for abforbing the colourlefs part of the
blood, which in a found animal convey only the
colourlefs parts, are to be fuppofed to form the
red globules. There is certainly an improbability
in it, to fuppofe that lymphatics that take in a
fluid from the furface of the fkin, fhall change its
nature, and convert it into red. Why lay the
burden upon that part of the fyftem called lym-
phatic? Why have recourfe to more than the
firft beginnings of the lacteals, and to fuppofe
that the food may be fo converted? But, to
fhew the abfurdity of fuch opinions, we find
that the experiment fucceeds in the fame way in
whatever organ of the body it is made. We
know from a great number of experiments, that
wherever we let in air upon the fenfible and deep
feated organs, whether we tie up the lymphatic
veffels or not, we fhall find red parts conveyed
through every lymphatic veffel, becaufe from the
irritation of the air fuch an inflammation is pro-
duced as gives occafion to the effufion of the red
parts, which are again taken up by the abforbent
fyftem.

XLVI.

But, further, if the fpleen was intended for
the formation of the red blood, why is the blood

fent from it into the liver? Why, after perform-
ing its office, does it not return in its fhorteft
road into the vena cava.

XLVII.

We may fay that the bile is thrown in to ᵤₑ ᵤ
the force of the blood, as it iﾍ in thé ſᵤₒᵤ́ᵗ
circulation that the bile is beſt tormᵖᵈ. Bᵤᵢ ᵤₙ
the herbivorous animals, where ᵢₕᵉ ᵢᵣᵤₑᵗ ᵢₛ lᵤᵣgᵤᵢ,
and more blood difperſed upon the alimᵉₙᵗᵃᵢy
canal, we ſtill find a fpleen : fc that it wᵤᵤlᵈ
appear that fome change, which we perhaps ſhᵤll
never be able to afcertaiᵤ abf ᵤᵗᶜlv, is pro ʰ ᵣᵉᵈ
on the blood in its paſſage through thᵤ ᵢₗₖᵣ ᵣ,
fuch as fits it for the feparation of the bilᵤ ᵤ
there is the ſtrongeſt ᵣᵉaſuᵢ to believe rhᵤt ᵤ
is fubfervient to the liver, thᵤᵤgh with ᵤᵢᵣ ᵤᵈ
to the manner, we ſhall perhaps never be aʲ lᵤ
fully to underſtand iᵗ. From exᵖᵉᵢiᵐᵉⁿᵗ₅ thᵤᵗ
have been made by cutting out the fpleen. ᵃⁿᵈ
obferving the changes made upon the bile, we cᵤⁿ
yet conclude nothing certain, and we can draw
the moſt general conclufions only, that it is con-
ftant in all animals in which bile is fecreted; and
in allᵧ the blood enters from it into the vena
portᵤrᵤm, which is the principal organ ferving
for the feparation of the bile.

XLVIII.

Anatomical Preparation of the Spleen.

As the texture of this organ is so soon broken down, it must be procured for injection in the most recent state. It is to be injected only by the artery and vein, since it possesses no excretory duct; and, if the organ is ful, the extremities of the veins will appear uniformly coloured. The after treatment is to be conducted in the same manner as described in the liver.

XLIX.

Pancreas.

The pancreas is a long flat gland of the conglomerate kind. It is situated in the epigastric region, and placed transversely on the back part of the abdomen, between the stomach and spine.

In shape it is said to resemble much the tongue of a dog and it possesses an elongation or process from one of its extremities, which adheres closely to the duodenum, and is termed its head.

L.

In describing more particularly its situation, the body of the pancreas passes before the upper part of the transverse portion of the duodenum, and over the aorta, vena cava, and part of the splenic vessels, to all of which it is attached; and through the intervention of the omentum, one end of it also is fixed to the spleen. Its membranes are derived from the mesocolon, and consist of two layers.

LI.

The ſtructure of the pancreas conſiſts of acini, which unite to form ſmall glands or lobes. A quantity of cellular ſubſtance looſely connects them, ſo that an external appearance of ſmooth-neſs and uniformity is afforded. The circulation of the pancreas has been already detailed in that of the preceding organs, its arteries ariſing from the hepatic and ſplenic by ſeveral branches which paſs into its ſubſtance in different places, and chiefly in a tranſverſe direction. Its veins obſerve the ſame name and courſe as its arteries, and terminate in the vena portæ.

LII.

From the different acini of this organ, ſmall ducts ariſe which unite and form larger ones, and in their courſe they obſerve a tranſverſe di-rection. They at laſt meet in one common duct, termed the pancreatic duct.

LIII.

The pancreatic duct begins at the left extremity of the pancreas, and runs in the ſubſtance of the gland, a little below its middle, gradually enlarging in ſize in its courſe in conſequence of the different branches joining it, till at laſt it is found equal to a ſmall quill. At the right ex-tremity of the organ it receives the duct of the elongation or proceſs, and it then terminates ob-

liquely in the duodenum, along with the ductus communis choledochus, though the place of this termination varies a little at times.

LIV.

The ufe of the pancreas is clearly to fecrete a fluid of a falivary nature, which is poured into the inteftines.

LV.

To fum up our opinion of this organ, we obferve, that it is the principal falivary gland. There is a famenefs of colour, a fimilar divifion into lobes, the coats of the ducts thin and tranfparent, very much refemble the coats of the inferior maxiliary gland, and fometimes concretions form within the ducts, refembling fome of the other falivary concretions, and they agree perfectly in colour and confiftence. One farther refemblance may be pointed out, that mercury affects thefe glands in like manner as the falivary glands are affected ; and it is fufpected that the diarrhœa which mercury produces, is very much owing to an increafed difcharge from the pancreas; and, when a pipe is fixed into the duct of the pancreas, a liquor like the faliva is difcharged from it.

LVI.

The arteries of the pancreas come from the fplenic arteries, nearly at right angles; and it happens that all the falivary glands are fupplied

with arteries much in the fame manner: fo
that the direction no ways correfponds to the
effect of mercury upon them, which was fup-
pofed to be thrown into the arch of the aörta
towards the head, and to be determined into
thefe glands by the direction of the arteries,
and the pancreas was overlooked. But it is
evident that the effect of mercury here is to be
explained upon the very fame principles as the
fecretion of the faliva. Why do thefe glands
feparate fpittle? Whoever fhall explain this,
will be better able to explain the other. They
both depend upon a particular organization, upon
minute circumftances in the ultimate divifion of
the veffels, and fenfibility of the nerves, circum-
ftances that altogether efcape us; fo, till we
explain this, it is in vain to fpeak of the other.

LVII.

Chemical Analyfis of the Pancreatic Juice.

The quantity of pancreatic juice fecreted, feems
equal to three times the quantity of faliva; and, by
chemical examination, the nature of the faliva and this
fecretion are found to correfpond, as far as can be
judged from fmell, tafte, colour, and confiftence.

Analyfis of Contents of the Chylopoetic Vifcera.

Having now demonftrated the chylopoetic vifcera,
and their affiftant organs, which pour their different
fecretions into them, it is proper to examine chemically

their contents, confiſting of the chyme, chyle, and faces.

Chyme.

Chyme is the product of the undigeſted food in the ſtomach. It is of a cineritious or yellow colour, and of a pultaceous, ſoft conſiſtence. From the nature of vegetable and animal matter, as food, its principles moſt conſiſt of;

1. The alible parts of ſuch matter-reduced into a pulp, or a ſoft maſs.

2. Thoſe parts of it which remain undecompoſible.

3. A union of ſaliva, gaſtric fluid, and mucus along with them.

In this ſtate it muſt paſs from the ſtomach into the ſmall inteſtines.

Chyle.

The chyme in the ſmall inteſtines is ſeparated into two parts, chyle and fœces.

The chyle is a whitiſh liquor, of a ſweet taſte. It much reſembles milk, but is of a thinner conſiſtence; and its reſemblance to milk appears ſtill ſtronger when it is more fully examined.

The quantity of chyle depends much on the nature of the food, but from 5 or 6 lbs., little more than ⅓ of this product is elaborated.

The conſtituent principles of chyle are much the ſame with thoſe of milk, conſiſting of a ſerous, oily, and coagulable part. Thus there is obtained from it;

1. Water, which is its greateſt proportion.

2. Oily cream, a combination of hydrogen and carbon.

3. Cheefe, or coagulum, formed from the carbon and azote of the food.

4. Earth, for calculi, are found in the thoracic duct and lacteals.

5. Animal lymph, as mixt with the juices of the inteftines.

From this view, chyle feems milk in a preparatory ftate, or poffeffing lefs of the coagulable or animal principle, which becomes perfected on its entering the thoracic duct, from its mixture with the contents of the lymphatics poured in here.

Fæces.

The fæces are a yellow or brown mafs of various confiftence in different parts of the inteftines, and expelled in a form moulded by that of the part they pafs through. They confift of the undigefted part of the aliment mixed with the bile and fecretion of the inteftines. They poffefs a difagreeable and peculiar odor, differing in different animals. They firft appear in the cæcum, and are faid to difcover a fweet tafte. Their quantity, daily, is not lefs than 4 or 5 oz, but this is regulated by the food, vegetable food affording a larger proportion than animal food.

The conflituent principles of the fæces are;

1. Water, for diftillation, reduces them to $\frac{1}{16}$ of their weight.

2. A fœtid principle affecting the noftrils.

3. Inflammable carbonated air, which, on being fet on fire, burns with a bluifh green flame.

4. The indigefted remains of the food, which the bowels cannot act upon; and

5. The mixture of inteſtinal e.cretiens, viz. bile, enteric and pancreatic juice, mucus, &c.

From this view, the ſaliva and gaſtric juice in the ſtomach make the preparatory change on the food by converting it into chyme, or give it the ſeparable ſtate of its alible principles. Thus, to take an example, milk is coagulated in the ſtomach in order to ſeparate its principles as the firſt ſtep of digeſtion. In the inteſtines, the bile and pancreatic juice make the ſubſequent alteration, by uniting theſe alible principles into a fluid or chyle, and ſeparating from this fluid the indigeſtible part, or fœces; and, in the thoracic duct, this fluid or chyle is perfected by its mixture with lymph, or the cortents of the lymphatic ſyſtem. From the thoracic duct it next paſſes into the general circulation, where the proceſs of reſpiration, as already noticed, beſtows on it the perfect animalized ſtate.

Lymph, then, would ſeem the fundamental preparatory menſtruum which is kept ready by the ſyſtem to be poured out in a variety of places, as the aliment deſcends in order to be united with it; for we find, on examination, that the ſaliva and pancreatic juice, and that the lymph, as far as we can judge by examination, agrees with each other in their nature.

The exact quantity of the excretions for the purpoſes of digeſtion ar' chyliſication, it is difficult to determine. For each meal, it is computed there is 6oz: of ſaliva; of bile, from the ſize of the liver, that there is not leſs than 24 oz.; and of pancreatic juice, there is 3 oz. The weight of theſe organs is rated at 3 lbs.

12 oz. to the liver, 3 oz. to the pancreas, and 14 oz. to the spleen. The flow of bile from the liver is greateſt when the ſtomach is diſtended from the preſſure of the organ againſt the ſtomach, and the reverſe of this takes place with reſpect to the gall bladder, which has its fluid preſſed out by the diſtenſion of the duodenum.

Thus the bile is the menſtruum that, by its combination, ſeparates the chyle and fœces, prevents the abſorption of the latter along with the former; and, by its irritation of the inteſtinal canal, haſtens its exit from the body.

During theſe proceſſes going on in the ſtomach and inteſtines, theſe organs are never deſtitute of the preſence of gaſes. In health, the quantity is ſmall, but they are accumulated by diſeaſe.

Gaſtric air, when examined, has been found to conſiſt of a mixture of four different kinds.

1. Carbonic acid gas, which is moſt in the ſtomach, and in ſmall quantity in the inteſtines.

2. Vital air, contained chiefly in the ſtomach and inteſtines.

3. Azote, and carbonated inflammable air, contained in the large inteſtines.

As the preſence, then, of the carbonic gas and vital air is greateſt in the ſtomach and ſmall inteſtines, ſo theſe gaſes are the fundamental principles of the chyle. Thus carbon, united with hydrogen, forms the oily or creamy part; and carbon, with azote, the cheeſy or coagulable part.

LVIII.

From the moveable, which we have now ex-
amined, we proceed next to what are termed the
fixed vifcera of the abdomen; the firſt of which
is the kidneys.

LIX.

The kidneys are two glandular bodies, of a
pale red colour, fituated on each fide of the vertebræ
of the loins, on the poſterior part of the abdo-
men, upon the two laſt ribs. The right kidney
lies under the great lobe of the liver, and is con-
fequently lower than the left one, which lies un-
der the fpleen. The concave fide of the kidneys
is turned inwards to the vertebræ, and the convex
fide outwards.

LX.

The kidneys poſſefs numerous connections.
The right one is attached to the liver and duo-
denum by means of cellular fubſtance, and its
peritonæal covering. The left one is connected
to the fpleen by the fame means, while both are
united to the mufcles on which they are placed,
and alfo to the renal glands and colon. From
thefe connections, they accompany the motions
of the liver and fpleen in the different ſtates of
refpiration.

LXI.

The fize of the kidneys is about five or fix
fingers' breadth in length; but it is confiderably

lefs from the outer to the inner fide, and ftill
lefs from before backwards. Hence it has been
compared to a kidney bean. The difpofition of
the veffels diftinguifhes the right kidney from the
left when taken out of the body.

LXII.

Each kidney is furrounded by a covering of loofe
cellular membrane, within which is contained a
confiderable quantity of fat; and this covering
invefts both the kidney itfelf, and alfo its large
veffels, fo as to defend them from the preffure
of the furrounding organs. On the removal of
this covering, the proper coat of the kidney ap-
pears, confifting of two layers, its proper mem-
brane, and condenfed cellular matter, which form
a ftrong adhefion to it, and are reflected over the
edges of the finus, to be joined to its pelvis and
large veffels.

LXIII.

The fubftance of the kidney is commonly de-
fcribed as fmooth and uniform; and where an
irregularity takes place, it is in confequence of its
original lobes not properly incorporating. It is
divided into two parts, a cortical or external part,
and a medullary or internal.

LXIV.

The cortical, or fecreting part of the kidney,
furrounds it fo as to form a third of its breadth;

and, by its proceffes, or partitions, the medullary parts are feparted from each other. The medullary, or uriniferous part of the kidney, is diftinguifhed, by its rednefs and diftinct columns; and thefe columns terminate in its papillæ, or mammilary proceffes. Thefe papillæ are connected to each other by cellular membrane; they form a continuation of the uriniferous part; their number is uncertain, amounting from eight to seventeen, and depending on the number of original lobes of which the kidney is compofed, and alfo on the incorporation of fome of the papillæ with each other. The points of the papillæ compofe the terminations of the uriniferous tubes; and thefe terminations through which the urine diftills, are diftinct to the eye. From the root of each papilla originates a membranous tube, termed the infundibulum, to receive the difcharge. The number of thefe tubes correfpond with the papillæ, unlefs where more than one papilla opens into the fame tube.

LXV.

In their progrefs, thefe tubes, or infundibula, unite into larger trunks, two or three in number; and by the expanfion of thefe trunks, a cavity of confiderable fize is formed; anfwering to the fhape of an inverted cone, and conftituting the pelvis of the kidney. In point of fituation, the pelvis is, for the greater part, without the body

of the kidney; it contracts at laſt into a long tube, diſtinguiſhed by the name of the ureter. · One of theſe tubes is appropriated to each kidney: but they have been occaſionally met with double in one or both kidneys. In their deſcent, the ureters paſs obliquely behind the peritonæum; and this obliquity is alſo obſerved in their inſertion into the bladder, which hinders the return of the urine from them. In their paſſage downwards, the ureters go over the great pſoas muſcles and iliac veſſels, at the fore and lateral parts of the ſacrum. Their termination is in the under, outer, and back part of the bladder.

LXVI.

Theſe tubes, in the courſe of their deſcent, have been compared to the letter _ſ_; and they occaſionally ſuffer dilatations and contractions, which occaſion ſome change of their cylindrical ſhape. Theſe contractions occur chiefly in their courſe over the pſoas muſcles, and their inſertion into the bladder. The ſtructure of the ureters is formed by three coats. The firſt is ſimply a peritonæal covering; the ſecond is of a muſcular nature, and formed chiefly of circular fibres; and the third, or internal, is villous, conſiſting of veſſels and ſmall excretory ducts, ſupplying a dif- charge of mucus to defend their ſurface from the urine.

LXVII.

The circulation of the kidneys requires next to be traced. Each kidney poflcffes one or more arteries derived from the aorta, and the correfponding vein or veins terminate in the cava. The entrance of its veffels into the kidney takes place at its finus, and they are enveloped in a cellular fubftance during their courfe. Of the arteries, the right one is longer than the left, from the circumftance of the vena cava being placed at the right fide of the aorta.

LXVIII.

In its approach to the kidney, a divifion of the artery takes place into branches, which are extended to extreme minutenefs through the cortical fubftance in the form of arches and anaftomofes; and the termination of this diftribution of them, after various turnings and windings, is partly on the furface of the kidney, when they affume an irregular ftar-like form, and partly internally, where they pafs in a waving direction, and affume an appearance fomewhat fimilar to clufters of fmall berries, vifible only by injection, or the affiftance of glaffes, and termed in this form, corpufcly.

LXIX.

In the fame manner the veins, on their return from their arterial extremities, unite in the cor-

tical fubftance of the kidney; and the branches of the vein, though they correfpond with the artery in their courfe, are much larger. They terminate on each fide in a trunk, which enters the cava in a tranfverfe direction; and the left vein is the largeft of the two.

LXX.

From the extreme arteries, or corpufcules, the uriniferous tubes take their origin, already defcribed as feated in the cortical fubftance: they form with their fmall vafcular congeries the medullary portion of the organ. In their courfe they unite into larger tubes, which affume in their paffage a radiated form, or run from the outer to the inner part of the cavity, and at laft extending in their fize, they terminate in the conical papillæ already defcribed.

LXXI.
Renal Capfules.

Above the renal veffels are fituated the appendages of the kidneys, or what are termed the renal glands. They are two fmall flat bodies, of a dark yellow colour. In their appearance they are glandular, and lie over the upper and fore part of the kidneys. Their figure is irregular; their length about two inches: but their fize is greater in proportion in the fœtus than in the

LXXII.

Thefe bodies are inveloped in cellular fub-
ſtance ſimilar to the covering of the kidney, and,
like it, they poſſeſs alſo a proper coat of a thin
texture, and firmly adhering to it. Their con-
nections to the contiguous parts are numerous.
The right one joins the liver, the left one the
ſpleen and pancreas; and, by the intervention of
cellular ſubſtance, they are both attached to the
diaphragm, the pſoas muſcles, and kidney. In
their ſtructure, theſe glands are frequently found
hollow, and they contain a dark-coloured or bili-
ous matter. Their circulation is ſupplied by the
adjacent organs; their arteries from the renal
aorta and diaphragmatica; and their veins ter-
minate, the right one in the cava, and the left
one in the renal vein.

LXXIII.

The uſe of the kidneys is evident by their ſecre-
tion: but the uſe of the renal glands is ſtill un-
diſcovered, and has given riſe to various conjec-
tures. From their particular ſituation, it is pro-
bable they are ſubſervient in their office to the
kidney, in the ſame manner as the ſpleen is to the
liver, and the pancreas to the parotids.

LXXIV.

Bladder of the Urine.

The termination of the ureters we found to be in the bladder of the urine, which is a large bag, fituated in the pelvis, or at the bottom of the hypogaftric region. This organ, when empty, contracts to a fmall fize, and occupies fimply the under and fore part of the pelvis ; but, on its diftenfion, it rifes above its brim, and fometimes afcends to nearly the height of the navel. The figure of the bladder varies according to the degree of its dilatation. When moderately diftended, it difplays an irregular oblong form, more capacious below than above.

LXXV.

This organ is divided into three parts; its fundus, its body, and its neck. The fituation of the firft being upwards and forwards; and of the laft, at its fore and under part.

LXXVI.

The attachments of the bladder are numerous to all the furrounding parts. Below, it is connected with the rectum. The peritonæum, and cellular fubftance, join it laterally to the pelvis in the form of ligaments. To the pubes it is attached by cellular fubftance alone; to the umbilicus it is fixed by the remains of the umbilical veffels, and the urachus running up from its fubftance.

But its firmeſt connection is a ligamentous ex-
panſion running on each ſide of its neck, and
fixing it to the internal arch of the pubes, where
the urethra alſo connects it to the penis.

LXXVII.

The bladder, like the other organs, poſſeſſes
ſeveral coverings connected by cellular matter.
The firſt is its peritonæal coat, paſſing from the
abdominal muſcles to it; and, when the bladder
is much diſtended, from its connection with the
peritonæum, it carries it with it, leaving a ſpace
between that membrane and the pubes.

LXXVIII.

The ſecond, or its muſcular one, is the moſt
important coat of the bladder. It is formed of
fleſhy fibres, ſo interwoven as to form faſciculi.
The external diviſion of theſe fibres obſerves a
longitudinal direction, and is connected at its
under and fore part with the bones of the pubes;
but, internally, its fibres form a net-work, and
obſerve no particular direction. At the neck of
the bladder, theſe fibres, by their contraction,
form the ſphincter. It is by the action of this
coat that the diſcharge of the bladder takes place;
and, by the ſeparate action of the fibres of the
neck from the fundus, an involuntary emiſſion of
the urine is prevented.

LXXIX.

Between the muscular and inner coat, the intervening cellular coat has been often considered as a distinct one; but for this there is no proper foundation.

LXXX.

The inner coat, or, as it is termed, the villous one, is a thin and smooth covering, somewhat unequal by the projection of the muscular fibres, and formed into rugæ when the organ is empty. This coat is possessed of much irritability; and the irritation of the urine excites it strongly at times to act. Hence, to guard against the discharge, it possesses a mucous secretion to blunt its acrimony, so as to prevent its being stimulated for the most part till the distension of the organ also co-operate.

LXXXI.

At its under part, the bladder is perforated in three different places. The anterior perforation is the commencement of the urethra, being surrounded by the neck of the bladder, and coming off at a right angle from its under part. The two other openings are situated behind, and form the terminations of the ureters. They are placed at a little distance from each other, and observe an equal distance from the beginning of the urethra as they do the one from the other. Their opening is somewhat of an oval form, and

. more contracted than the fpace of the ureter immediately above.

LXXXII.

The circulation of the bladder is fupplied from various fources. Its arteries are chiefly from the umbilical and pudenda communis, and its veins terminate in the internal iliacs, which form a plexus of confiderable fize on each fide of the bladder.

LXXXIII.

The fecretion from the kidney is tranfmitted to the bladder through the ureters by drops, or fmall thread-like ftreams; and, when accumulated, the quantity and actimony of the fecretion forces the organ to contract in order to expell it. In doing this, the action of the organ itfelf is alfo affifted by the abdominal mufcles and diaphragm preffing the bowels againft the organ. The frequency of this operation depends on a variety of circum-ftances, as the fize of the bladder, its degree of fenfibility, the quantity of the urine, and its irritating quality.

LXXXIV.

From this view of the urinary organs, the kidney appears defended by a quantity of fat from the preffure of the abdominal vifcera, and by the like means it is defended from the lumbar vertebræ, which lie behind, the tunica adipofa being upon the back part as well as the fore.

There is next a proper membrane, not derived from
the peritonæum, connecting the several lobes that
is found in the fœtus, and it is in a confiderable
degree formed of cellular fubftance condenfed,
but not entirely, for the inner fide of it has the
fame fmoothnefs as a portion of the peritonæum.
When the kidney is cut into, two fubftances are
obfervable. Firft, the cortical glandular, or vaf-
cular part. From this part tubes are fent in-
wards; and as they are collected from the whole
furface, they give the cortical appearance. At
their end we find the papillæ, from which the
urine is difcharged into the pelvis of the kidney;
and the papillæ project into the kidney, to give
room for more ducts, and alfo that the urine
may not regurgitate, or be pufhed back into the
mafs of blood; fo that the more the pelvis of the
kidney is diftended, the fides of the papillæ are
the more compreffed.

LXXXV.

As the kidney is originally compofed of a
number of different lobes, there appear many
infundibula uniting into one common duct, like
branches of veins collected, and there is no cer-
tain rule, with regard to the number, or manner
of joining; in fome infundibula there is a fingle
papilla, and in fome two, &c. and alfo the number
of infundibula varies.

LXXXVI.

From the pelvis of the kidney, the urine paſſes
down to the ureter, where it gets the conical ſhape
from the number of canals forming it. Thus ſtones
may more readily form here, and where they
do, they may not get down through the narrow
ureter, but may remain in the kidney. The
ureter is not entirely cylindrical, but varies in its
ſize, and that in different places, for which no
cauſe can be aſſigned, except at the turn where
it gets into the pelvis ; and this explains the
various motions of a ſtone in the ureter. At the
lower end, it paſſes ſo obliquely into the bladder
as to ſerve the place of a valve, and at the ſame
time the mouth is contracted, ſo that a ſtone
may readily be interrupted at its entrance ; this in
women gives room for an operation, by which the
life of a perſon may be ſaved. The ureter has a
ſe coat of the muſcular kind, and another denſe
and ſmooth coat within it, and the action of the
ureter may be ſeen very diſtinctly, contracting
itſelf like a worm upon a very ſlight irritation.
it is material to obſerve this, that it is not to be
conſidered as a mere membranous tube ; and in
the caſe of the deſcent of a ſtone, we ſee the
advantage of giving opium, for, by leſſening the
pain, the ſpaſm is taken off, and the relaxation of
the muſcular coat lying upon it, by which means
the urine may puſh on the ſtone into the bladder.

LXXXVII.

The bladder is of a curious and complex structure; and here the common opinion, with regard to the extent of muscular contraction, is contradicted; for the bladder can contain 2lbs. of urine, and its fibres are at the same time capable of contracting so in all directions as to expel every drop of this, which shews that muscular fibres possess a very extensive power.

LXXXVIII.

Nor is there observable any particular muscle serving as a spincter, and yet we possess two opposite powers of pushing the urine out, and stopping it, at pleasure; and hence muscular fibres can act so that one part of the fibre is an antagonist to the other, or we can employ parts of fibres to perform an office; we can relax the one part, and employ the other; and that it can be done alternately. The internal coat of the bladder is very dilatable, so may be pushed out by a stone, between the fibres of the muscular coat, in which case there will be difficulty in extracting the stone.

LXXXIX.

The name of villous, applied to the inner coat of the bladder, which is smooth, is evidently improper. We do not find all the fibres in the muscular coat running from the mouth of the

fundus, but many of them run obliquely; and we can only fay, that many bundles of fibres begin at the neck, run up to the fundus, come down upon the oppofite fide, and crofs a little when they reach the neck; or that we find the fibres very fitly difpofed for contracting the bladder into all its directions. The defcription, therefore, of a diftinct fpincter mufcle is improper; all that can be demonftrated is, that the circular fibres grow a little thicker, and the longitudinal and oblique decuffate each other, but without forming a complete circle, as is obfervable at the pylorus, or without there being any diftinct mufcle, as we find at the extremity of the inteftinum rectum.

· XC.

Chemical Analyfis of the Urine.

The fecretion of the kidneys, or the urine, is divided into the crude or cocted. The former being an immediate difcharge after food or drink, and therefore copious, and occafionally vitiated by certain impregnations; the latter thicker, more coloured, and acrid, and emitted in the morning after fleep.

This difcharge is of a citrine or ftraw colour, pof-feffes a temperature equal to the blood, is faltifh and naufeous to the tafte, and in its confiftence thicker than water.

Its quantity is regulated by the quantity of fluids taken in, and the ftate of the feafon.

By the ufual tefts, urine difcovers neither an acid nor alkaline nature. By farther experiment, it is proved

entirely an aqueous, not a serous fluid; and, by its eva-
poration, its chief products are compound salts.

The progress of urine to putrescency, is more rapid
than that of any of the other animal fluids, and its
changes in the open air, in passing to this state, deserve
attention. On its first discharge, it remains pellucid
for some time; but, at last, there appears at bottom a
a small cloud, or marks of a consolidated gluten, which
thickens and increases till it occupies the whole vessel,
and renders the urine opake. As this process advances,
the smell of the urine is changed, becoming putrid and
cadaverous, and a cuticle is formed on the surface of
the vessel, composed of minute crystals.

The urine next regains its transparency, and acquires
a brown, instead of its yellowish colour. Its smell also
changes to an alkaline nature, and a brown grumous
sediment is deposited at the bottom filled with white
particles subject to deliquescence, and so conglutinated,
as to resemble soft calculi. In this state the urine
effervesces with acids.

By evaporation of 36 oz. of urine, one ounce and a
half of residuum is procured, containing the following
proportion of ingredients. Muriatic salts, 1 dram.
Phosphoric salts, 3 drams, 50 grains. Uric acid, and
phosphate of lime, 25 grains. Animal extractive matter,
3 drams, 40 grains.

Thus the recent urine contains an excess of phos-
phoric acid, which it soon loses for the prevalence of
ammonia ; but, of all its ingredients, the most remark-
able is the uric, an excrementitious substance surcharged
with nitrogen, the excess of which it carries off from
the body.   *5

The general conſtituent principles of the urine are ;

1. Water, in ſuch a proportion, that from 20 oz , 19 of this fluid were obtained.

2. An odorous principle, perceptible to the ſmell,

3. Phoſphoraꞇed ſoda, as aſcertained by calcination of the dry extraꞓt, and its ſolution in water.

4. Phoſphorated ammonia, which is aſcertained by allowing a ſolution of calcined extraꞓt of urine in ſpirit of wine to cryſtallize the microcoſmic ſalt of urine, is found conſiſting of ammonia, ſoda, and phoſphoric acꞏd.

5. Calculous matter, in the form of a browniſh red earthy gluten, ano conſrſting of gluten, animal earth, and uric acid, as diſpiayed by the analyſis of calculi.

6. The extraꞓtive principle of urine, or uric ; and,

7. Compound ſalts ; as, muriaꞇe of potaſh, and muriaꞇe of ſoda.

No animal fluid is ſubjeꞓt to ſo much variety as the urine, and this happens from the effeꞓt of

1. Age; for its acrimony gradually increaſes with the progreſs of life.

2. Drink ; for cold and copious draughtꞇ render it pale ; while green tea, caſſia, pulp, render it green.

3. Food ; for aſparagus or olives give it a peculiar ſmell, and faſꞇing renders it turbid.

4. Medicines. Thus rhubarb gives it a yellow tinge, and turperꞇine a violet colour.

5. Period of ſeaſon; for, in winter it is copious and aqueous ; in ſummer, ſparing, high coloured, and acrid : an influence equally diſplayed alſo by the climate.

6. Muscular action; for, by motion its secretion is leſſened, and increaſed by reſt.

7. Affections of the mind. Thus fear renders its ſecretion pale.

Anatomical Preparation of the Meſentery.

In order to inject its veſſel, proper care muſt be taken to ſecure their extremities. When this is done, one of the largeſt arteries and veins near the root of the meſentery ſhould be choſen, and into them proper pipes fixed, and the injection conducted with two liquors of different colours. The injection will enter every part of the meſentery and inteſtines freely, in conſequence of their numerous anaſtomoſis.

Anatomical Preparation of the Kidney.

For injection, a kidney as found as poſſible ſhould be choſen, and there are three orders of veſſels in it to be injected in order to ſhew their ramifications by corro-ſion. The artery here is diſtinguiſhable by its greater thickneſs and elaſticity, and alſo by being generally ſmaller than the vein; and the duct is known by its enlargement near its entrance into the kidney. Proper ſized pipes then being fixed into the different veſſels, proceed according to the directions given in the other organs, to fill each ſet of veſſels with a different coloured injection; and, after the pipes are removed, the kidney is to be immerſed in the acid ſolution for five or ſix weeks, t ll the texture of every part is deſtroyed, and may be waſhed off from the corroded preparation.

For the purpoſes of injection, the kidney ſhould be carefully removed from the body, and no part of it wounded, or any of its fat removed.

XCI.

Having now purfued the defcending aorta, or vafcular diftribution through the thorax and abdomen, before examining the organs peculiar to the fexes, or tracing the circulation of the extremities, it is proper to return and view that of the upper parts, as carried on by the afcending aorta.

XCII.

From the arch of the aorta, which they entirely occupy, come off three great arteries that rife to the head, or decline laterally towards the arms; and by them are nourifhed all the upper parts of the body. The firft of them is the right carotid and fubclavian, formed by its divifions above the the arch about an inch. The fecond is the left carotid, going to the head; and the third is the left fubclavian, going to the left arm.

XCIII.

We fhall examine the diftribution of the carotid artery firft. This artery having emerged from the thorax, runs up along the neck by the fide of the trachea, in one divifion, till it touches the lower jaw. In this courfe it conftantly recedes from the fore part of the throat, getting gradually deeper till protected by the projection of the larynx. It divides, at the jaw, into two branches, termed the external and internal carotids; the one going to the outfide of the head, the

other to the brain. And, in order to underſtand the circulation here, it will be neceſſary to examine firſt the general ſtructure of the ſeveral organs theſe particular veſſels are deſtined to ſupply.

XCIV.
Brain.

The firſt, and moſt important of theſe organs, next to the heart, is the brain, or origin of the nervous ſyſtem. It is that maſs which, with its incloſing coverings, fills the cavity of the cranium ; and in the human ſubject, it exceeds in proportionate ſize to the brain of every other animal.

XCV.

The coverings of this part conſiſts of three ,membranes. The dura-mater, arachnoid coat, and pia mater.

XCVI.
Dura Mater.

The dura mater forms the external incloſure, and is the means of connecting this organ to the cranium, which it lines. Though but a ſingle membrane, it is in ſeveral places diviſible, by maceration, into layers.

XCVII.

In its texture, this membrane poſſeſſes conſiderable denſity, and may be conſidered as the thickeſt and ſtrongeſt in the body, approaching ſomewhat to tendon in the ſtrength of its fibres. Its adheſion to the ſurface of the cranium is

equally ftrong as that of the perioftæum to the bones elfewhere; and this adhefion is particularly firm at the futures and openings, or foramina, and is even ftronger in childhood than in age. On its external furface it forms a fmooth lining to the brain, only attached at the place where the veins are expanded into finufes, and it is every-where lubricated by a ferous excretion from its veffels.

XCVIII.

By the fecretion of the fluid of this membrane, the different ftates of refpiration are prevented from injuring the organ; and, fimilar to the peri-oftæum of the bones, it forms both a defence to the brain, and conveys nourifhment to the internal layers of the fkull. By it, alfo, the fituation of the brain is preferved fteady, and various proceffes proceed from it, which divide the brain into cer-tain parts.

XCIX.

Thus, when the cranium is circularly cut, there is found a very confiderable adhefion of the dura mater to it; and, when it is drawn afunder, we obferve a great number of red points which are the extremities of lacerated veffels. Hence we conceive that the dura mater ferves as the external perioftæum to the inner table of the fkull; and the ufe we affign to it is, that of fupplying the bone with veffels. Hence, in performing opera-

tions, as in the trepan, we fhould be extremely cautious not to detach more of it than is abfolute-ly neceffary; and for the fame confideration that we avoid to fcrape the perioftæum from a bone, viz. leaft we fhould bring on a caries. It is farther obfervable, that there can be no fuch motion of the dura mater as was formerly alleged; and, upon attending to the communication which the veffels upon the oppofite fide of the fkull have with each other, it appears probable that the affection of the external membrane may diforder the dura mater, but not, however, in fuch a degree as has been fuppofed. Where the pericranium is feparated with violence, the dura mater will be detached too, but this is not from the communication of the veffels, but from the fame violence affecting both; but, in fuch cafes, we frequently find the dura mater adhering. As the thicknefs of the dura mater is more confiderable than the external perioftæum, it may ferve alfo, as obferved, like a foft cufhion to defend the very tender fubftance of the brain.

C.

The proceffes of the dura mater are three in number; the fuperior longitudinal procefs, or falx; the lateral one, or tranfverfe feptum; and the minor falx, or fyplum of the cerebellum.

CI.

• The 1*ſt* is that doubling of the membrane which feparates the brain into two hemifpheres, commencing at the middle of the fphenoid and ethmoid bones, and pervading the upper and middle part of the head, along which courfe it poffeffes adhefions to the different bones, being ſtraight in its direction, and in ſhape refembling a falx or fickle, expanding at the fame time gradually in its progrefs from the cranium to near the corpus callofum, and terminating behind in the middle of the tentorium. It is this procefs that fupports the tentorium, and thus prevents the preffure of the two fides of the brain on each other.

CII.

The 2*d*, or tranfverfe feptum, runs from the former to the os petrofum, and is connected behind to the inner tranfverfe ridges and grooves of the occipital bone, terminating at the pofterior part of the fphenoid bone. This procefs forms a arch or vault over the cerebellum, and prevents the preffure of the cerebellum upon it.

CIII.

The 3*d*, or central feptum, is placed between the lobes of the cerebellum. It defcends from the under and back part of the falx, and adheres to the inferior longitudinal fpine of the occipital bone, and terminates at the edge of the foramen magnum.

CIV.

Befides thefe, fmall proceffes of the dura mater pafs out at the different openings of the cranium, which are of lefs importance, but which all ferve to connect it with the adjacent parts.

CV.

From this fituation of the fepta, and there going down a confiderable way betwixt the hemifpheres of the brain, and from obferving the appearance of the dura mater, there is fome foundation for faying that this is a double membrane, the two layers of which adhere very clofely, and the middle parts are fofter, and connected by ftrong cellular threads. In the fame manner, when the brain is raifed from the cerebellum, there appears a fimilar membrane ftretched between them, all which evidently prevent one part of the brain from gravitating upon the other in the different poftures of the body, while thefe two membranes, viz. the falx and tentorium, mutually fupport each other; and, in fome very large and fwift animals, we find the partition formed of bone. Not fatif-fied with covering the brain, we find that the dura mater runs down into the fpine, ferving the fame office to the fpinal marrow as to the brain in general; and, laftly, we obferve where the nerves go out to the external parts, that mem-brane is wrapt clofe about them.

CVI.

The circulation of the dura mater is chiefly from the external carotid, the internal one, and the vertebrals, as we fhall afterwards find ; but what is only to be noticed here is, the particular termination of its veins in finufes, for the tranf-miffion of the blood from the head to the neck. Thefe finufes are formed by a tenfe doubling of the membrane over them, fo as to be little affeted by the preffure of the adjacent parts.

CVII.

Thefe finufes are chiefly diftinguifhed by the ftrength of their coats, and their frequent communications ; and their fituations are,

1. The fuperior longitudinal one, which beginning at the crifta galli of the ethmoid bone, directs its courfe along the upper edge of the falx, enlarging in its progrefs, and terminating in the lateral finufes.

2. The torcular of Hierophilus, which runs between the falx and tentorium, and terminates with the former finus in the beginnings of the lateral ones.

3. The two lateral finufes formed by the longitudinal and torcular ones, which obferve a varied courfe, firft running tranfverfely, then in a winding direction downwards, obferving the depreffions of the occipital and temporal bones, till they

terminate at the bafe of the cranium, in the begin-
ning of the internal jugular veins.

CVIII.

Thus the finufes are the trunks of veins covered
by the dura mater, and fmall branches enter at
the fides of it. We fhall afterwards find feveral
ufeful purpofes ferved by this ftructure, that the
veins are greatly ftrengthened by it, and feveral
dangers thereby avoided; and, as the fmall
branches pafs obliquely through the dura mater,
this oblique paffage ferves the office of valves.

CIX.

On the fides of the finufes, and elfewhere on
the dura mater, fmall granulations are apparent, of
a whitifh, and alfo of a flefhy colour, the ufe of
which is unknown.

CX.

Arachnoid Coat.

The fecond covering of the brain is the arach-
noid coat, fo named from its refemblance to a
fpider's web. It forms a very thin tranfparent
membrane without any appearance of veffels.
Its expanfions feem confined entirely to the fur-
face of the brain, and it infinuates itfelf no way
into its fubftance or convolutions.

CXI.

The adhefion of this membrane is greateft at
its upper part, where the connection by cellular
fubftance is fo ftrong, as hardly to bear fepara-

tion; but in other parts it appears to lie merely
. in contact, and is easily raised from the other parts.

The use of this membrane is like the former, to
cover and defend the parts over which it is spread.

CXII.

Pia Mater.

The third covering of the brain, the pia mater,
somewhat resembles the former in its tenderness,
but possesses vascularity. It differs however from
it, besides being a covering, in its insinuating itself
deep into every part of the substance of the organ,
and it forms the lining of the ventricles. It is
in this membrane the vessels of the brain are con-
tained, and by it they are supported and allowed
to separate into the minute divisions which are
necessary for its circulation and functions.

CXIII.

The circulation of this membrane we shall after-
wards trace. It is only remarkable in so far that
its veins do not accompany its arteries.

CXIV.

Brain, or Cerebrum.

The brain is divisible into four different parts,
the chief of which are the cerebrum and cere-
bellum. The cerebrum completely fills the upper
part of the cranium, and is divided into two
halves, termed its hemispheres, that are preserved
separate by means of the falx.

CXV.

Each of the hemifpheres difplays an oval form; the inner fides of which are flat, and the upper and outer convex, while the inferior furface is irregular. Hence it is divided into two anterior, two lateral, and two pofterior lobes or proceffes.

CXVI.

The fituation of the firft of thefe is in the fore part of the cranium; that of the fecond in the depreffions or pits formed by the temporal and fphenoid bones; and that of the third over the cerebellum, from which they are feparated by the tentorium. Between the firft and fecond there is a confpicuous furrow formed by the anterior cle-noid proceffes of the fphenoid bone, termed the large pit, or foffa of Sylvius.

CXVII.

In examining the furface of the brain, it is divided into numerous windings or turnings, termed convolutions. Thefe run in various di-rections. They are alfo of different fizes and lengths in the feveral parts of the brain. A connection between them and the pia mater is every where confpicuous by the intervention of fmall veffels entering the fubftance of the brain; and, to detect this, it is neceffary to make a flight feparation of the convolutions from each other.

CXVIII.

The evident purpofes of thefe convolutions is o increafe the external furface, in order to give room for the very minute divifions of the blood veffels; for the pia mater, or vafcular membrane, defcends between each of the convolutions, and the feveral doublings of the pia mater are kept together by the very fine coat without veffels. The arachnoid is connected to the pia mater by cellular fubftance, and we may confider it likewife as defending the very tender veffels of the pia mater. Perhaps, farther, the arachnoid coat may prevent the concretions better than a membrane, with a great number of different veffels, and we find that nature guards againft the contact of the dura mater with the furface of the brain, by the interpofition of a liquor. If that liquor fhould at any time be collected in an unufual quantity, fo as to form a Hydrocephalus internus, the water would fall down into the fpinal marrow, between the two membranes, in confequence of which the vertebræ may be pufhed outwards, fo as to give the appearance of the fpina bifida.

CXIX.

Between the hemifpheres is obfervable a white medullary fubftance, fomewhat firmer than the texture of the brain, named the corpus callofum. It croffes the brain immediately under the falx,

and running horizontally, joins the the two hemi-
fpheres to each other. Its middle is marked by a
longitudinal raphe, and on each fide of it a medul-
lary chord, giving origin to many tranfverfe ftreaks.

CXX.

On cutting into the brain, immediately on a
line with this corpus callofum, the fubftance of
the organ difcovers a divifion into two parts, an
outer or cortical one, and an inner or medullary
one. The firft receives various appellations,
being named cortical, from its manner of fur-
rounding the medullary part, or being, as it
were, the bark of it. It is termed cineritious,
from its grey or afh colour; and it is ftyled alfo
glandular, or fecretory, from its fuppofed func-
tions. The extent of this part is general over
the brain, it paffes deep between its convolutions,
and is a congeries of veffels conveying its circula-
tion without the appearance of any particular
fibrous texture.

CXXI.

The medullary, or white part, is regarded as
the origin of the nerves, and has been termed,
from its fuppofed ftrufture, the excretory duft
of the brain. It differs from the other part, by
exceeding it both in quantity and firmnefs of
texture; but fo intimately are they connefted,
that it at the fame time appears but its continua-
tion. Its fibres run in a parallel or tranfverfe

direction, and the medullary and cortical parts are found in different places blended with each other. On thefe two different fubftances of the brain we obferve that the cortical or cineritious fubftance is by no means fo thick as we are apt to conceive it ; the deception is owing to the convolutions of the brain, the thicknefs being only about $\frac{1}{6}$ part of an inch.

CXXII.

The cortical fubftance has every where the pia mater immediately applied to it, then the medullary fubftance is every where connected with the cortical, fo that we cannot fhew medullary fibres without being able to trace thefe back to a cortical fubftance, or a cortical fubftance which does not form medullary.

CXXIII.

Thus there prevails a ftrong connection between the pia mater and the cortical fubftance of the brain, the veffels of which it is evidently intended to conduct : for, if a fection of the brain is examined, the veffels of the pia mater appear lodged perpendicularly into the cortical fubftance. Not that it can be proved entirely made of veffels, for a confiderable part of it ftill retains its former appearances. Connected to this appears alfo the medullary part, which is of a fibrous nature, and the direction of the bundles of fibres can be traced, and that the nerves are its continuation.

But, where they leave the fubftance of the brain, without exception they are covered by the continuation of the pia mater, or a vafcular membrane refembling that. And, if they are intended for the external parts, and to run along the mufcular organs, there is another fheath from the dura mater, or one fo like it, that it may be held the fame.

CXXIV.

The fibres of the medullary fubftance can be feen with the naked eye, and it can farther be feen that the nerves are every where their continuation; but, at the fame time, all the medullary fibres are not continued to form nerves; fome of them are continued in a direction that is the moft unfavourable to the formation of nerves, and the fibres that compofe the fubftance of the brain and cerebellum is much greater than that of all the nerves joined together.

CXXV.

On removing the cortical part of the brain, a nucleus is formed by the medullary fubftance alone, termed the centrum ovale of Vicffceuns; and, to obtain a proper infpection of it, the nucleus fhould be cut fo as to preferve the corpus callofum; and the fame convexity is confpicuous as in the general furface of the brain. By this centrum ovale is formed the roof or vault over the lateral ventricles, and its fmooth uniform under furface conftitutes their upper part.

CXXVI.

The ventricles of the brain are four in number, lined with a fine fmooth membrane continued from the pia mater, but with lefs vafcularity than that membrane. Thefe ventricles are compofed of medullary matter, with their fides contiguous to each other, and having their cavity conftantly moiftened by a ferous excretion.

CXXVII.

The lateral, or fuperior ventricles, run horizontally with the hemifphere in which they are fituated, one to each. They lie under the centrum ovale, of an irregular form, with each three winding corners, termed cornua, from their refemblance to rams' horns.

CXXVIII.

The feptum lucidum forms a feparation between the anterior cornua. The pofterior cornua, though fituated at a diftance from each other, and termed alfo digital cavities, at their pointed extremities approach nearer to each other. The inferior cornua obferve a courfe downwards and forwards, fo as to end in the lateral lobes of the brain.

CXXIX.

Each of the pofterior cornua is diftinguifhed by an elongation ending in a point, termed the hippocampus minor. In the bottom of the lateral ventricles two eminences are placed anteriorly, named

corpora ftriata, which gradually turn narrow, and recede from each other as they advance pofteriorly to their termination. Thefe eminences difcover externally a cortical ftructure, but within are mixed with medullary ftreaks, fome of which form large tranfverfe circles, and others obferve a ftraight direction.

CXXX.

Between the corpora ftriata, at their pofterior part, are fituated the thalami nervorum opticorum, cortical without, and medullary and ftriated within. Upon the extremities of their furface are placed tubercles, or eminences. The thalami, internally, are flat and contiguous, and above their furface forms one clofe attachment, named the commiffura mollis of the opti thalami. In their courfe pofteriorly, the thalami pafs downwards and upwards; in which direction they become elongated into two white chords, named tractus optici.

CXXXI.

The thalami are covered by the choroid plexus, or a vafcular membranous congeries, formed by the ramifications of arteries and veins connected by the pia mater, and fpread upon the furface of the thalami and adjacent parts.

CXXXII.

Returning to the corpus callofum, under its raphe appears the feptum lucidum, forming a partition between the lateral ventricles. The form

of this feptum is broad before, narrow behind, and curved at its edge; and its connections are above to the corpus callofum, and below to the fornix.

CXXXIII.

The compofition of this part is of cortical and medullary laminæ. At their fore part they are feparated from each other by the fiffure or finus of the feptum lucidum. This finus, however, has no communication with the lateral ventricle, though at times it moves confiderably backwards.

CXXXIV.

Under the feptum lucidum appears the fornix, a continuation of the corpus callofum; fo termed, by the antients, from its refemblance to a vault. From the hollow cavity which it forms, proceed four winding pillars, or cornua, two anterior, and two pofterior. The two former are fhort, and clofely connected in their courfe; the two laft are long, more diftant from each other, and correfpond from their curvatures with the inferior cornua of the lateral ventricles. The thin borders of their under parts, fituated within the latter, are termed corpora fimbriata.

CXXXV.

In its figure, the fornix is broad before and behind, where connected with the corpus callofum. The pofterior part of its body below is impreffed

with oblique lines refembling a lyre, and there-
fore named pfalterium. The connections of the
body of the fornix are above to the feptum lucidum,
below to the thalami optici, by means of a vafcular
membrane, named tela choroidea, which, fpread-
ing over the thalami, unites the choroid plexus of
the lateral ventricles.

CXXXVI.

In the inferior prolongations of the latter are
two medullary eminences, which take their origin
from the fides of the corpus callofum, at its
pofterior extremity. Thefe eminences are termed
pedes hippocampi. They obferve the fame courfe
as the pelloris, and have been fuppofed as forming
part of them. They arife by a fmall origin, and
gradually enlarge as they advance to their extremity.
A medullary lamina forms their external covering,
and their internal ftructure fhews a convoluted
appearance, compofed both of cortical and medul-
lary laminæ. The inner edge of the pedes hippo-
campi difplays an indented margin, proportionally
larger in quadrupeds, and lefs in man.

CXXXVII.

The openings of the ventricles are the next
important part. The firft is an oval hole, by
which the lateral ventricles communicate freely
with each other. It is placed at their bottom,
behind the crura of the fornix, and the meeting
of the choroid plexus.

CXXXVIII.

The fecond lobe is the iter ad infundibulum, or ventriculum tertius, feen on dividing and turning back the fornix. The third lobe is the foramen commune pofterius, between the commiffura mollis of the optic thalami and the pineal gland.

CXXXIX.

The third ventricle ftill remains, and it is only a deep fiffure between the inner ends of the thalami optici, being bounded above by the commiffura mollis, below by the crura cerebri, and on each fide by the bodies of the thalami.

CXL.

A paffage of confiderable fize, of a cortical and medullary ftrudure, termed the infundibulum, comes next into review. It leads downwards and forwards, and gradually contracts till it becomes folid at its termination. This is in the glandula pituitaria, and thus it prevents the tranfition of any fluid from it to the nofe.

CXLI.

The glandula pituitaria is of an oval form, about the fize of a bean, of a brownifh colour, formed of cortical fubftance, and mixed within with medullary matter. This gland is lodged in the fella turcica, furrounded by a doubling of the dura mater; and the ufe of it is completely unknown.

CXLII.

The next parts to be noticed are two medullary cords.

The firſt is termed commiſſura cerebri anterior, and is ſituated at the fore part of the third ventricle, running tranſverſely through the corpora ſtriata.

The ſecond, ſhorter than the former, is the commiſſura cerebri poſterior, ſituated at the back part of the third ventricle, under the root of the pineal gland.

CXLIII.

The fourth ventricle has a paſſage leading to it, under the name of canalis medius, from the back part of the third one; and next, in removing the poſterior part of the fornix, and tela choroidea at this back part of the third ventricle, a number of peculiar diviſions of the brain that ſtill remain, come into view.

CXLIV.

The firſt of theſe is the nates placed uppermoſt. The ſecond are the teſtes immediately below the former, of a white colour, broader from ſide to ſide than in any other direction. Theſe tubercula are externally medullary, and within cortical. Their names are more proper in quadrupeds than in man, from their greater proportional difference of ſize.

CXLV.

Under the back part of the fornix, over the nates, is placed the pineal gland. It is a fmall cortical body, like a fir cone in fhape, and in fize like a garden pea, always prefent, and feldom found difeafed; hence confidered as the feat of the foul. This gland, at the root, is fixed to the pofterior commiffura cerebri, and fends out two long medullary peduncles, to be fixed to the upper fide of the thalami, and anterior crura of the fornix. In the fubftance of the pineal gland, fmall calcarious concretions are obfervable after the age of puberty, termed acervulus cerebri.

CXLVI.

Thus within the brain are found many tubercles, and there feems to be a neceffity fome how or other, for reafons that perhaps we cannot conjecture, that the feveral tubercles be kept fiom adhering to each other; hence we find ventricles within the brain, and it is of ufe to obferve thefe hollows for the fake of difeafe. We have feen their place and manner of communication; the two lateral ventricles communicate with each other under the anterior crura of the fornix; between thefe and the choroid plexus the communication is large enough to receive a large fized quill. At the fame time they communicate with the third ventricle, the hole being open underneath; and the third, by the iter ad quartum

ventriculum, communicates with the fourth, so
that it is pretty certain that the glandula pituitaria
is of the same nature with the lymphatic glands in
the rest of the body.

CXLVII.

From the cerebrum we proceed to its appendage
the cerebellum. It is situated under its posterior
lobes, separated from it by the tentorium, and
occupying the inferior fossæ of the occipital bone.

CXLVIII.

Its size equals only about $\frac{1}{5}$ or $\frac{1}{6}$ of the brain.
It is more simple in its structure, and somewhat
roundish in its form. Like the brain, also, it is
divided by the falx minor into two hemispheres,
but possesses no separation above. Like the brain,
also, it is marked by numerous convolutions in
the form of arches decussating each other; and
these observe a lateral direction, consisting of
laminæ with deep furrows; between each the pia
mater is insinuated in the same manner as in the
brain.

CXLIX.

Two middle eminences are marked out in the
cerebellum, named apendices vermiformes from
their resemblance to an earthworm, one of which
is placed anteriorly, the other behind.

CL.

The lobes of the cerebellum are also divided
into smaller parts, lobules or monticuli, and vari-

.ous names are affigned to thefe, according to their particular fituation and connections. They admit fome variety, and are chiefly diftinguifhed by the direction of their convolutions.

CLI.

In fubftance, the cerebrum and cerebellum are the fame, only the cerebrum poffeffes a greater proportion of the cortical part ; and, from the peculiar diftribution of the medullary laminæ when the cerebellum is cut vertically, it difplays the appearance of a branching fhrub, termed therefore arbor vitæ.

CLII.

This medullary fubftance, when cut into, is laminated; and, at a confiderable depth, there appears a centrum medullare uniting the lateral lobes as in the brain.

CLIII.

The next part that falls here to be defcribed, is the fourth ventricle ; the fituation of which is between the cerebellum tuber annulare and upper part of the medulla oblongata, and it extends from the teftes to the inferior notch of the cerebellum. As it defcends from the teftes it becomes wider, forming an angle behind, from which it contracts till it terminates in a point, termed the calamus fcriptorius. Over the upper part of this ventricle is placed a thin medullary lamina, termed the valve ; and at the fide of this

valve, are two medullary tracts, termed pro-
ceſſus ad teſtrs. The under part of the ventricle
is ſhut by its choroid plexus, ſo that no commu-
nication can take place between it and the ſpine.

CLIV.

Under Surface of the Brain.

Between the lateral lobes of the brain, at its
baſe, are placed two ſmall round white bodies,
named copora albicantia, being without of a medul-
lary, and within of a cortical ſubſtance. In theſe
bodies are the terminations of various medullary
ſtriata from different parts.

CLV.

Immediately before theſe bodies appear two
white cords named the pedunculi cerebri, which
originating from the medullary ſubſtance of the
brain, gradually approximate in their courſe, till
they unite in the tuber annulare. They are com-
poſed of medullary fibres, and poſſeſs, internally, a
mixture ● cortical and medullary matter; the
former of which is ſo conſpicuous at one parti-
cular part, as to give it a darker colour, and
occaſions it to be named locus niger crurum
cerebri.

CLVI.

A cortical ſubſtance, termed pons tarini, forms
a junction of the oppoſite ſides of the crura ce-
rebri, and corpora albicantia together; and it
further aſſiſts to compoſe the bottom of the third

.ventricle. Two white cords alfo arife from the
medullary part of the cerebellum, entitled the
crura cerebelli; and with the crura cerebelli,
they compofe the tuber annulare, or pens Varolii,
which forms a ring or bridge at it were over thefe
crura. Thus the tuber is fituated over the body
of the fphenoid and cuneiform proceffes of the
occipital bones. It is ftretched along its furface,
and divided by a longitudinal depreffion from the
courfe of the vertebral artery into two lateral
parts. It contains in its fubftance much cortical
matter, the ftriæ of which obferve various direc-
tions. Extending from the tuber, appears the
medulla oblongata, a large fubftance in the form
of an inverted cone, and reaching to the foramen
magnum of the occipital bone. On its furface
appear two fmall longitudinal contiguous emi-
nences, named, from their fhape, corpora pyrami-
dalia, between which there is a deep fiffure, pene-
trated by the pia mater, for the paffage of blood
veffels into the interior medulla. At the outfide
of thefe eminences are alfo two others, named,
from their appearance, corpora olivaria; and ftill
more externally are a third and lefs diftinct pair,
termed corpora pyramidalia lateralia.

CLVII.

The medulla oblongata, thus fituated, is formed
of medullary matter externally, and cortical within,
joined by medullary; and it is divided by means

of an anterior and pofterior fiffure into two lateral
portions.

CLVIII.

Thus we have examined the brain in its feveral
parts, or that organ which is the fource of ner-
vous influence, the primary organ of fenfe with
which the mind is fuppofed to be immediately and
moft intimately connected; we fhall next purfue
the detail of its circulation, which is alfo peculiar
and important. We formerly traced the external
carotid to the angle of the lower jaw. There it
divides into two great branches; the firft, pre-
ferving the name of external, is diftributed on the
outfide of the head; while the fecond, the internal
branch, paffes, in order to give circulation to the
brain; and, in doing this, it is affifted by two others,
the vertebral arteries, which arife from a different
fource, or the axillary. By thefe arteries paffing
on each fide into the head, an immenfe fupply of
blood is conveyed to the organ, and not lefs, on
the moft moderate calculation, than $\frac{1}{7}$ of the
whole mafs; and, as the arteries are large, and
their action powerful, the violence of their circu-
lation from being injurious to the foft texture of
the brain, is purpofely counteracted by a number
of circumftances.

CLIX.

The 1ft of thefe circumftances is the tortuous
courfe of the arteries, as they pafs into the head.

. The 2*d* is the entrance of the carotid to the head through a long bony canal, giving refiftance to its impulfe.

The 3*d* is 'the minute divifion of the arteries, and their difperfing on the pia mater before they pafs into the fubftance of the brain ; and

The 4*th* is the thinnefs of the arterial coats in the brain from what they are elfewhere.

CLX.

With thefe peculiarities in the circulation of the head, the carotid, on entering it by the os petrofum, gives off three branches at the fide of the fella turcica, which it firft reaches.

CLXI.

Arteria Media Cerebri.

The 1*ft* is the middle artery of the brain, which is to be confidered as the arterial trunk. It runs ftraight along the foffa fylvii, formerly defcribed, and goes directly outwards towards the temple. In the foffa fylvii it divides into two branches, a deep and fuperficial one, but its main circulation is fpent on the middle lobe of the brain. Previous to its lodgement in the foffa fylvii, it gives off fome fmall delicate twigs, which are diftributed to the pituitary gland, the optic nerve, the tentorium, and pia mater, at the cranial bafe. The chief of thefe twigs are the artery of the choroid plexus running up into the anterior horn of the lateral ventricles and the plexus of arteries, like fewing

threads scattered over the crura cerebri and base of the brain, and marked by their numerous inofculations.

CLXII.

Arteria Anterior Cerebri.

The next division of the carotid is named the fore artery of the brain, which observes a straight course along the anterior lobe. It gives-off branches to the olefactory and optic nerves. The branches then, of this artery, on each side meet, and form a communication just before the sella turcica and pituitary gland. From this part it dispatches a branch to the third ventricle, which gives off subdivisions to the fore part of the fornix and septum lucidum. Its two divisions then rise, and keep the course of that separation which the falx makes between the hemispheres, the one observing a deep, the other a superficial route.

CLXIII.

Arteria Communicans.

While the former artery goes to the fore, this one passes to the back part of the brain. It goes round the sides of the corpora mammillaria, and it soon meets the vertebral artery, and thus it forms, though itself a small artery, one of the largest and most important inosculations in the body. This inosculation is termed the circle of Willis; and the vertebral artery, thus connected, gives off three divisions; two to the cerebellum, and one to the back part of the brain.

CLXIV.

Vertebral Artery.

This artery arifing from the axillary one, con-veys much blood to the brain, and it obferves the fame courfe and precautions with the carotid be-fore its entrance to the organ. On entering the foramen magnum, it foon meets its fellow, and the two unite into the bafilar artery, which lies upon the cuneiform procefs of the os occipitis and the tuber annulare of the brain, which it marks with a furrow or depreffion, and in its progrefs it gives off fmall twigs to the adjacent parts. On the vertebral paffing into the bafilar artery, it fends off the lower artery of the cerebellum. It differs in its fize on each fide, and is fometimes wanting. It moves down in a retrograde courfe, and dives in between the cerebellum and medulla oblongata. When the vertebral artery arrives at the pons Varolii or tuber annulare, it fends off at once four arteries, two to each fide of the brain. The firft, or thofe to the right fide, named arteria cerebelli, bend round the crura cerebri to get at the cerebellum, to which it gives branches afide to the vermis. The fecond, or thofe that pafs to the left fide, named arteria pofterior cerebri, ob-ferve the fame bending courfe with the former, and go into the divifion between the cerebrum and cerebellum, running up to the back lobes of the brain. They fend off alfo numerous twigs in

every part of their courfe, and they inofculate . with the middle artery of the brain, and that of the corpus callofum.

CLXV.

Thus by the internal carotid and vertebral arteries is the whole brain amply fupplied with blood; of the membranes, the veffels of the pia mater are derived from the fame fource; but the dura mater, on the contrary, receives only a part from this quarter, and its chief circulation is from the external carotid.

CLXVI.

Having thus feen the diftribution of the internal carotid, or chief cerebral artery, and obferved alfo that it freely communicates with the vertebral one, there appears little danger of the ftoppage of the blood in any part of the organ, and numerous examples occur of anaftomofes between the internal and external arteries; hence, after tying the carotis communis, not only the functions of the brain continue, but alfo thofe of the external parts, the blood getting through the vertebral to the internal carotids, and from thefe into the external ones. From thefe communications it has been propofed, where the head feems to be oppreffed with too great a quantity of blood, which is frequently a caufe of apoplexy, perhaps alfo of epilepfy, to leffen the quantity by tying one of the carotids. Now, although, from

.the vicinity of the nerves of the eighth pair and intercoftals, this experiment is attended with a confiderable degree of danger, independent of that from tyiilg the artery ; yet, furely, the idea is worth purfuhng in other animals; fo in the ftaggers, or epilepfy in a horfe, we might tie one of the carotids to fee the effect.

CLXVII.

Next, attending to the fituation of the carotids with refpect to each other, the internal is fent off at an angle, and the external is the more direct continuation of the trunk ; and the vertebral arteries arife at a right angle, and form the fub-clavian. We find that both the arteries which fupply the brain come off in an unfavourable manner.

CLXVIII.

When we profecute the particular branches of the external carotid, the firft branch is fent to the larynx, and then turning downwards, it enters the thyroid gland, where it freely com-municates with an afcending artery; and, ex-amining the ftructure of the gland, we find that a great quantity of blood is circulating here. It is of ufe to attend to the fize in certain opera-tions, particularly in bronchotomy, where we muft generally cut through this gland ; and, if this .is done, the blood getting into the trachea, may raife a .convulfive cough, which is attended with

real danger. Now, confidering that operation,. we may reflect on the ways of gaining advantage in certain cafes of inflammation, and of avoiding the danger of blood falling into the lungs.

CLXIX.

Higher than this, a confiderable branch of the lingual paffes above the corner of the os hyoides, which, joined to its fellow, conveys a very large portion of blood. It is of ufe to judge of its fituation in chirurgical operations, where tumours prefs in here, and we do not readily know its courfe by the finger, becaufe it is fupported chiefly by flefh, fo that we fcarcely diftinguifh its pulfation.

CLXX.

The next artery we call facial, fupplying the infe-rior maxillary, and fublingual gland. The branches are fet off at right angles, as thofe of the temporal artery, that fupplies the temporal glands. So thefe are not more particularly fitted to receive the very active mercury than the others; and the effect of the artery in throwing out the mercury, is not to be afcribed to its paffing off at a right angle, but to the ftructure of the ultimate branches, or of the gland, and the greater fenfibility of the part.

CLXXI.

Going ftill higher, we find the facial artery paffing over the lower jaw, about an inch from its angle, fo called arteria angularis ; and here we

can diftinguifh the pulfation, and can open it on certain occafions. In fome operations we allow the parts to bleed freely; and it may be of advantage to empty all the veffels very fully; but in many other cafes we wifh to ftop the bleeding, as in the operation for the hare lip, in the cafe of wounds, &c. And furgeons generally ufe preffure upon the extremity of the bleeding artery, or take it up with the needle. But applying two fingers upon the root of the facial artery, will affift very confiderably; not but that the blood will be poured in in fmall quantity from the neighbouring branches; but if the principal fource is interrupted, that will be found to ceafe.

CLXXII.

Purfuing the facial artery higher on the face, we find it fupplying the fmall glands of the lips; and the ferpentine turn it takes ferves a double purpofe, allowing an extenfion of the mouth, the artery coming nearer to the ftraight line; but the turns are greater than what is neceffary for that purpofe; and confidering the fituation of the veffels within the mufcles, we may conceive that, from the fituation and courfe, the faliva is better prepared, and the fecretion increafed by the motion as well as the exertion. At the top of the face we find the artery communicating with the ocular and frontal ones, or communications between the internal and external arte-

ries. Hence the room for Dr. Blain's propofal to
open the frontal artery in the difeafes of the head;
but this operation is to be avoided particularly,
from the artery being turned over a bone, fo that
it is impoffible to relax it.

CLXXIII.

Following the artery ftill higher, we find the
occipital one fent backwards. From the root of the
temporal artery, the trunk of the carotids is turned
inwards, and then it gets the name of the internal
maxillary, fplitting into a number of very great
branches, fupplying the mufcles, the fubftance
of the jaws, the roof of the mouth; and there
is a branch going into the dura mater, and to
the artery terminating in the fides of the nofe,
which is a continuation of the external carotid.
Though thefe feveral branches never fall in the
way of a furgeon, yet it is of ufe to know from
what fource each organ receives its blood; and
the knowledge of their connections and vicinity
may be of advantage in certain dangerous difeafes,
to leffen this force very confiderably. Thus, if
the dura mater is inflamed to a great degree, or
in the cafe of teething in children, the force of
the blood may be more leffened by opening the
temporal artery in the neighbourhood, than by
opening veffels that are more diftant.

CLXXIV.

Correfponding to the arteries, there are two

sets of veins, viz. the internal jugular attending the carotis communis, and two external jugulars. So that even in this part of the body, where the blood returns the moſt readily to the heart in the erect poſture, there are under our muſcular organs veins running in very different directions, and one ſet on the outſide of the muſcles, free from the action of the muſcles, and frequently communicating.

CLXXV.

In the external jugular veins there are alſo valves which are in proof that they are chiefly intended to prevent the blood from being driven backwards to the ſmall branches.

CLXXVI.

From the free communication which the external jugulars have with the internal, it is clear that the drawing blood from them in diſeaſes of the head, may be attended with particular benefit; and the only danger attending the opening of them, ariſes from certain ſmall nerves, branches of the cervicales.

CLXXVII.

Having now traced the ſtructure of the brain, and its circulation, there are ſeveral things that merit attention in review.

CLXXVIII.

From the appearance of the internal carotid and vertebral arteries, it is clear that a greater

than the common proportion of blood is circulated
here; thus, comparing the brain and cerebellum
with the arm upon which we find only the axil-
lary artery fpent, each of the internal carotids
are nearly as large, and the two vertebrals joined
together are larger; or there is about three times
the quantity circulated within the head that paffes
through the arm.   The quantity, however, is
not fo great as fome fuppofe.   If the quantity is
to be judged of, nearly one-tenth, or one-twelfth
of the whole is circulated upon the furface of the
brain and cerebellum; but we are obliged to make
a deduction from this proportion, becaufe the
force of the blood within the head is broken from
a number of circumftances: the momentum is in
a fingular manner diminifhed.   An allowance muft
be made for the blood rifing contrary to its
weight; and this has greater effect than is com-
monly imagined.   In a perfon difpofed to dropfy,
it generally appears firft in the feet: from the
defcent of the blood the exhalation is greater, as
well as the abforption more difficult; and a
change of pofture in inflammatory cafes is fome-
times attended with particular advantage.   Be-
fides, when we attend to the coats of the arteries,
they are very thin within the head, and even
without the head; they are thinner in the ex-
tremities, and are thinner in the fuperior extre-
mities than in the lower, though both are equally

affected by the action of muscles. So the momentum is confiderably diminifhed by the afcent of the blood, and it is leffened alio from the thinnefs of the coats, for the living power of the arteries contributes to carry on the circulation.

CLXXIX.

In addition to thefe circumftances, both arteries, the carotid and vertebral, make more turns in running upwards than are neceffary. We do not fee the ufe of the turn made by the internal carotid on the outfide, and ftill lefs any neceffity for the feveral turns it makes in its paffage through the os petrofum. Surely we can affign no other purpofe, than that nature intends to break the force of the circulation; and in other animals, where the head is depending, and the force greater upon the arteries, they are in a fingular manner divided into minute branches, which are collected from a trunk a fecond time, whereby the force of the blood muft be greatly broken, as it is from its paffage from the arteries into the veins.

CLXXX.

When the arteries are purfued further, we perceive that the branches bear a great proportion to the trunks; we cannot make an exact comparifon with the other arteries, but we can readily perceive that they are numerous, and the furface of the pia mater is vaftly increafed by the doub-

lings in the convolutions of the brain and cerebel-
lum. But notwithstanding these several circum-
stances that diminish the force of the blood, we
are by no means to conceive that the arteries of the
brain want pulsation, and that the blood moves
in them nearly in the same manner as it moves
through innumerable tubes. The reasons given
for this are by no means conclusive, as that the
carotid artery passes through a hole in the cra-
nium, and has its sides glued to the hole. The
coats have, indeed, no motion in the os pe-
trosum, but it does not prevent the impulse of the
heart, for the pulsation remains in an artery
after it is cut in the middle, and the ends of it
joined by a tube; and the pulsation of the arteries
of the brain has been distinguished after the skull
was removed. But it has been alleged that there
is not the same motion before the skull is broken,
and that it is owing to the air having access,
while before this these arteries could not contract,
otherwise it would form a void. Now, if it can
be supposed that all the veins that let out the
blood are accurately tied up, after the artery is
fully stretched it cannot be emptied. But if the
artery and vein run parallel, and the heart gives
a stroke, this is extended, and passing upon the
brain, it pushes the blood down to the heart;
and now the coats contracting, push the blood
forwards into the brain. So the blood moves in

the fame manner in the thinner part of the head
as in the reft of the body, by the alternate dilata-
tion and contraction of the arteries.

CLXXXI.

It is alfo to be recollected, that the obftruction
in any particular part is guarded againft by the
unufual joining and anaftomofis of the princi-
pal trunks; fo that a circulation is formed round
the fella turcica; and therefore, though from
accident, or difeafe, or perhaps of motion of the
head, &c. any one of the four principal arteries
is ftopped, the blood can pafs to every minute
termination in the head; and in proof of which,
the common carotis may be tied, and yet the
ordinary functions performed. So, upon the
whole, we find a more than common quantity of
blood furnifhed to the origin of the nerves, and
that this is circulated in a very curious manner;
it paffes in the ufual way into the beginning
of the veins accompanying the fmaller arteries,
but thefe terminate in finufes, which receive a
covering from the dura mater, the ufe of which
is very confiderable, and they are fo formed and
difpofed, that the brain cannot very much difturb
the motion, as they only run where the dura mater
is drawn out, fupported, and made tenfe; nor
can the finufes fwell out much, fo as to difturb
the functions of the brain, from their being fo
glued to the bones. When we confider their

shape accurately, we find it somewhat like three portions of a circle joined together. So we see one material use of the sinuses. But there is another, by the adding the dura mater to the veins, a greater thickness is given to them; and, by the veins passing into them in an oblique manner, the same effect is produced as if they had been provided with valves at their openings. Hence, when the sinuses are injected, it is seldom we succeed in filling the small veins of the brain: for there is an oblique entrance into them like that into the biliary or urinary ducts, which serves the purpose of valves, and this is of consequence: for the blood passes with greater difficulty, in expiration than in inspiration. Thus, when there is a stagnation of the blood on the right side of the heart; and if, at the same time, whilst violent exertions are made by the heart, the body should be bended, and the muscles of the neck in action, the blood might have been thrown back into the thin veins: but, in consequence of the oblique passage, though the blood should be thrown back with considerable force, they receive almost nothing of the impulse.

CLXXXII.

From the sinuses the blood passes into the internal jugular vein: this is a vessel of very considerable size, and is made larger in proportion to its artery. So anatomists mistake in conceiving

the finufes great receptacles of blood, in which
it undergoes great changes. The lateral finufes
are fcarcely larger, compared with the carotid
and vertebral arteries, than the veins are in other
places. But their coats yield readily in the
human body; and in animals that dive under
water, we find large bags to prevent the accumu-
lation of the blood within the head.

CLXXXIII.

There are two motions in the brain. 1*ſt*, The
common pulfation, produced by the ſtrokes of
the heart. 2*d*, In the unequal ſtates of refpira-
tion there is a confiderable preſſure backwards;
for the internal jugular has but a pair of valves,
which do not accurately prevent the regurgitation
of the blood, and the diſcharge of the ſmaller
veins into the finufes is for fome time ſtopped,
and hence takes place a confiderable fwelling of
the larger branches of the veins entering into
them. If a confiderable portion of the ſkull is
removed, and the membranes detached, that alter-
nate dilatation is ſeen in a very remarkable de-
gree;" and we are apt to be deceived in fuppofing
that fuch a motion takes place before the brain is
opened; but there is no fuch heaving of it in
ordinary, as occurs in this experiment; for, fup-
pofe a fingle half ounce is thrown into the brain,
the whole impulfe appears at the fpot. However,
though we allow that the brain has a pulfation of

its arteries as in other places, and that there is no
great difference in the return of the venous blood,
we have it not in our power to empty the veſſels
of the brain by letting blood, as we can empty the
veſſels of other parts. Thus, if a pound of blood
is drawn from the arm, the veſſels are emptied,
the bulk of many parts of the arm are leſſened,
and the veins ſubſide and become ſmaller. But
this cannot happen in the brain, which conſtantly
contains nearly the ſame quantity, abſolutely the
ſame, if we conſider the large and ſmall veſſels:
thus, if the large veſſels receive a violent impulſe,
they make a ſtrong preſſure againſt the ſmaller, and
ſqueeze out their liquors towards the heart, and
the quantity contained in the brain will be at all
times equal, nor can we leſſen its bulk without
making a void.

<h3 style="text-align:center">CLXXXIV.</h3>

From the danger ariſing from a ſtoppage of the
blood within the head, it has been imagined that
when perſons have been killed by hanging, it muſt
be owing to the ſtagnation of the blood within
the head. But the blood continues to find its way
into the heart, although there may be a kind of
ſtupor and oppreſſion from the preſſure upon the
veſſels; for, upon opening the trachea arteria of
a dog, it was kept hanging three quarters of an
hour without being killed; but, upon putting the
rope under the hole, it was found irrecoverably

dead after feven minutes; fo that the death is chiefly owing to the ftoppage of the refpiration. And the only circumftance for diftinguifhing whether a perfon has been hanged before death, is, that if he is killed by hanging there is a purpleifh ring about the neck, which is not produced by hanging a dead body upon a rope.

CLXXXV.

In the fpinal marrow the circulation is carried on in the fame equable manner as in the head, the quantity of blood is proportionally great, there are every where anaftomofes of the veffels, and the fame means are taken to break the force of the blood in them.

CLXXXVI.

Eye.

After the demonftration of the brain, and its circulation now profecuted, we fhall view its expanfion in one important organ, and the particular ftructure of the latter, or the eye. The fituation of this organ was formerly pointed out in the Ofteology, and the different parts of the orbits or bony cavity demonftrated. They are lined by the continuation of the dura mater, which becomes connected with the perioftæum of the face.

CLXXXVII.

Eye Brows.

The firft pair to be here noticed is the eye-

brow, or the arch of hairs on the superciliary ridge of the frontal bone. Their position is oblique, with their roots to the nose, and their situation is elevated by a quantity of cellular substance. They are covered by the surrounding muscles. In their use, besides ornament, they form a shade and defence to the eye, and also assist in expressing the passions.

CLXXXVIII.
Eye Lids.

The second part to be examined is the eye lids, which are a doubling of the skin, inverted at the edge of the lid, and then laid over the fore part of the ball, so that, though common teguments, from the edge of the eye lid they become a great deal thinner, but the same general structure remains; and the vessels shining through, communicate their colour. Hence we find, that where an inflammation attacks the eye, the loose skin within the eye lid swells out, sometimes, almost to cover the cornea. In the doubling of the eye lid there is a firm substance, the shape of which is seen on turning out the eye lid; it is intended to prevent the eye lid from wrinkling, to stretch it properly, and make it take the figure of the ball. This is called the ciliary cartilage, and is largest in the upper eye lid, which chiefly possesses motion. Immediately within the hairs upon the eye lids, which are longer

in thofe of the upper than under lid, is perceived a vaft number of fmall openings that are juft vifible to the naked eye. They are the mouths of ducts which are fituated upon the cartilage below the inner fkin; their length is nearly equal to the breadth of the cartilage; they run in a ferpentine direction, and the matter they contain appears yellowifh when we look at the ducts lying upon the cartilage, but upon fqueezing the ducts we find it whiter. Thefe ducts ferve to prevent the injury that would arife from the meeting of our eye lids, by leffening the friction. They are very often the fubject of difeafe, where the eyes are tender; and we are obliged to fupply the want of this matter. Hence the ufe of the opthalmic ointments.

CLXXXIX.

Lacrymal Gland.

The next part that comes into review is the lacrymal gland, fituated in a hollow, at the upper and outer part of the eye, behind the outer end of the fuperciliary frontal ridge. It is an oblong yellowifh gland, with one end pointed to the nofe, and the other to the angle of the eye. A chain of fmaller glands is alfo confpicuous in the fame fituation, connected with it; the excretory ducts are numerous, but from their minutenefs difficultly traced.

CXC.
Puncta Lacrymalia.

From the gland we are led to the puncta lacrymalia, two small orifices in the lids, at the inner angle of the eye, one above and another below, which hold the direction of the edge of the lids, and terminate in the lacrymal sac.

CXCI.
Caruncula Lacrymalis.

They are kept separate by the caruncula lacrymalis, a small sebaceous gland, which is situated beside them, and for preserving the functions of which it is intended. Between this part and the ball of the eye lies also the valvula semilunaris, or conjunctive crescent, with its horns directed to the puncta, in order to assist the course of the tears in passing into them. In other animals it is large, and termed the membrana nictitans.

CXCII.

With this previous structure we are brought to the ball of the eye. In attending to its general form, we observe that it is composed chiefly of coats and humours, with a nervous and vascular structure.

CXCIII.
Ball of the Eye.

The fore part of the eye is rounder than the rest, or the cornea is a portion of a smaller

circle above that, formed by the tunica fclerotis, which makes a portion of a larger circle, and the optic nerve enters the eye towards one fide, neareft the inner fide. The lens is flatter upon the fore than the back part, and the ciliary proceffes are connected to the edge of the chryftalline lens.

CXCIV.

It is not fufficient that the bottom of our eye be made more fenfible than the reft of its body in order to perceive the impreffions of light, but it is alfo neceffary that the light be collected, as the rays of the fun are collected with a burning glafs, by which means the rays make a fharper ftroke upon the retina. The humours of the eye, three in number, the aqueous, chryftalline, and vitreous, are perfectly fit for defending the fenfible bottom, and for collecting the rays. By their pellucidity they allow them to pafs through, by their foftnefs they defend the parts, and by their fhape they collect the rays, which form a picture of the object at the bottom of the eye.

CXCV.

Humours of the Eye.
Chryftalline Lens.

Of the humours, the chryftalline lens, the middle one is the principal, for with it, when out of the body, a picture can be formed as with a burning glafs; fo that it is calculated to collect

the rays upon the bottom of the eye, and it can
do this independent of affistance from the other
parts, though thefe co-operate.   In its ftructure,
the lens is a firm fubftance, inclofed in a capfule,
and which gradually grows fofter towards the
edges.   This has led to the opinion, that a fluid
is interpofed between the capfule and the lens.
But in a recent fubject, there is only a folid; and
the reafon of the softnefs is, that in all fubftances
the rays are collected in an unequal manner, the
edges drawing them to a point fooner than the
middle.   Hence there is no perfect focus made by
art; but here, in confequence of the softnefs,
the light is lefs gathered at the edge, fo that all
the rays unite at the bottom of the eye

<div align="center">CXCVI.</div>

There are veffels of confiderable fize that are
feen upon the capfule in children, which after-
wards exclude the red globules, but continue to cir-
culate the other parts of the blood.   This ftructure
ferves to prevent the tender eyes of children from
being injured by the light; and there is a want
of clearnefs in their vifion.   Hence the capfule is
provided with veffels, fo that in certain cafes that
membrane may be thickened by inflammation,
and be a caufe of opacity.   Hence, alfo, although
in the cataract, the opacity is chiefly feated in
the body of the lens, it may be confined to the
capfule; for, after the body of the lens has been

extracted, it sometimes becomes opaque from the wound, and the admission of the air, becoming thicker and darker.

CXCVII.

Vitreous Humour.

The vitreous humour is placed between the lens and bottom of the eye. It appears like the glare of an egg, but we have reason to believe that it is confined in a capsule, though that is not so evident. It has been considered as splitting on the fore part into two divisions, when, in reality, it is difficult to show from dissection its existence; only the surface remains for a considerable time smooth, and we see vessels running through the middle of the vitreous humour, and we can scarcely suppose that they want a membrane to support them. Its principal use is to support the lens at the proper distance from the bottom of the eye, as on a cushion; and by its being thinner than the lens, it also assists in collecting the rays; for if it had not been interposed, the picture would have formed behind the retina.

CXCVIII.

Aqueous Humour.

The aqueous humour is placed between the lens and cornea, in which the iris is placed, so that it is partly lodged on the one side, and partly on the other side of the iris, possessing what are called the anterior and posterior chambers;

the anterior the larger. We are uncertain whence it is derived, whether from the cornea or iris; but we suspect that it is from the latter, as the vessels upon the iris seem better fitted for providing this humour, which is regenerated in the space of 24 hours; and we have seen an injection with turpentine rising from the iris through the aqueous humour, probably imitating the natural secretion. The aqueous humour allows the motion of the curtain, the iris, to regulate the light passing through the eye. Besides, the chryst̄all̄ī n̄ is much better removed from danger, as from blows, &c. a slight rub might have disordered the lens, its vessels, and capsule; and there is reason to imagine that it helps to keep the cornea transparent, for it is naturally interposed between the layers, and passes through these; and after death the eye loses its shape, this humour exuding through the cornea.

CXCIX.

Coats of the Eye.

From the humours, we come to the containing parts, the several coats of the eye, beginning with the innermost, the retina, which is the continuation of the optic nerve, and takes its rise from the thalami nervorum opticorum, from a certain tubercle forming the bottom of the lateral ventricles, and the sides of the third ventricle. Hence we understand why in the internal hydrocephalus the

eye comes to be affected: there the thalami are
fqueezed on two fides, above by the water in the
lateral ventricles, and within by that in the third,
the ventricles all communicating. So the affec-
tion of the eye points out the collection within
the head.

CC.

When thefe nerves are traced from the thalami,
we find that they are united. It is conceived
that this union is made by a cellular fubftance;
but we can in this way give no rational account
of the union, and there appears a real intermix-
ture or decuffation of fibres, or that the right
optic nerve is formed from both the thalami nearly
wholly; and the advantage of this is apparent, for
that one the half of the fenfibility of both
fhould be preferved, than that the fenfibility of
one fhould be altogether loft. Many advantages
are derived from two eyes; and from their uni-
form motion, diftances are better judged of, and
accidents better guarded againft; and a particular
advantage arifes from the mixture of the optic
nerves where they adhere.

CCI.

On following the nerve into the eye, it is
crooked a little between the foramen opticum and
ball of the eye, to allow the free motion by the
recti mufcles; it then enters, though not directly,
oppofite to the pupil, but at the inner fide. Now,

what reason do we assign for this? An experiment shews the use of it in the clearest manner. If the picture is brought to fall upon the entrance of the optic nerve, you lose the object altogether. Thus, if we shut one eye, and look at a piece of chalk before us, and see it from the image falling on the outside, turning our eye so far, we lose it: this we might suppose owing to the obliquity; but following it a little further, we see it again: and, on making the experiment with accuracy, we find that we lose an object whose diameter is equal to one-ninth of the distance; so, nine feet distant from the eye, you will lose a circle one foot in diameter.

CCII.

It is material to attend to this, because many have imagined the insibility to be owing to the small artery entering with the nerve; but we find, on making a calculation, that the whole medullary substance, or entrance of the nerve, is insensible, the nerve not being spread into parts fine enough to receive the impression; as when a nerve is spread upon the tongue or nose, the nerve is not fitted to receive the impression. The nerve enters towards the inner side, and we find, from attending to the angle the eye forms with the object, that the entrance is somewhat more than ⅛ of an inch removed from the centre of the eye: "thus, suppose you pass a needle through the eye,

and meafure from the bottom fomewhat more
than ⅛ of an inch, that is the place where the
optic nerve enters. The reafon of its entering
at the inner fide is evident; if the nerve had
entered at the outer fide, pictures of a fingle
object would have formed at the fame inftant in
both eyes, but the rays fall upon the outer fide of
the left, when on the inner fide of the right.

CCIII.

Retina.

We find the nerve forming the retina, which
is the expanfion of the medullary fubftance. The
name is improper, for it is an uniform membrane,
and no net-work, which would have loft parts of
the objects, for it expreffes nothing more than a
web uniformly extended upon the inner fide,
covering the vitreous humour. It has been de-
fcribed as going to the edge of the chryftalline
lens, and fome of the fibres paffing over it. But
it is unneceffary that they fhould extend over the
lens; it would have difturbed the vifion upon the
pofterior part, and we find that it terminates like
the edge of a tea-cup behind the lens. There
may be fome fibre, perhaps, going forwards to
the chryftalline lens; it may receive a nervous
fibre from the retina, though it feems rather to
receive it along with the veffels.

CCIV.

Choroid Coat.

It is covered by the choroid coat, the inner side of which is incrusted with a black point, forming the appearance of a membrane. .That serves the very oppofite purpofe of quick-filver on the back of a mirror, it prevents the reflection of the light, or its being thrown back again fo as to make a fecond impreffion, it fuffocates the rays. From the experiment, that the entrance of the optic nerve is infenfible, other anatomifts concluded that this coat was the organ on which the picture made its impreffion. But we obferve that blind-nefs is occafioned by a difeafe of the thalami nervi optici, by preffure upon them, or what is the ufe of the retina, why fo fine a web, if it is only a fort of cover to the choroid ? Next, purfuing the choroid as a web and firm fubftance, we find it makes a turn, and it is connected to the chryftalline lens by what has been named the ciliary proceffes, which are only the terminations of this coat con-tracted into a narrower circle, juft as the fleeve of a fhirt is folded into a number of doublings at the wrift. Hence there is no fpace for light paffing between the ciliary proceffes and the lens; if there was, the aqueous humour would mix with the vitreous, but it feparates thefe, and ferves to fupport the chryftalline lens in its place, which refts upon the vitreous humour as upon a cufhion,

AND DISSECTION.

cix

and is supported at the edges by the continuation of the choroid coat. This opinion has led to very wrong ideas of the part affected in difeafes of the eye, all the rays of light that ftrike the retina have before that paffed through the chryftalline lens. Thus, if a cataract is uncommonly opaque from the want of fenfibility to light, we are not immediately to infer that the retina is in a difeafed ftate, unlefs we find other circumftances that may lead us to fufpect this.

CCV.

Iris.

We next confider the iris, defcribed as the continuation of the choroid coat, one part of which is fuppofed to form the ciliary proceffes, and the other the iris; but other anatomifts obferve, that the iris is totally diftinct from the choroid, and is merely connected to it by the ciliary circle, or they are joined by cellular fubftance, which alfo connects the iris to the fclerotic coat, fo that the watery humour is prevented by the ciliary circle from entering between the fclerotic coat and the choroid; and thus we obferve a white opaque fubftance, forming a ciliary ligament at the root of the iris. The iris has an aperture in the middle, which we call the pupil of the eye. When we follow the veffels of the iris in an injected preparation, thefe are chiefly derived from the choroid coat, and we find nerves entering in confiderable number. Near the root

of the iris there is a circular artery, or at its root
all the vessels communicate ; we then trace them
to the edge of the iris, and follow them all this
course with the naked eye, and yet many ana-
tomists imagine that no red blood enters the iris,
and that its vessels convey colourless humours
only ; but besides this evidence, from the appear-
ance of the vessels, from accidents, we know that,
the iris circulates a confiderable quantity of red
blood, which is feen mixed with the aqueous
humour. In fuch cafes, a cloud or film appears
within the cornea, and upon holding the head
fteady, the cloud goes off. That proceeds from the
red blood being mixed with the aqueous humour.
When the head is held in one pofition, the blood
falls to the bottom of the humour, and the iris
is not connected where the fclerotic coat joins
the cornea, but behind the joining, fo that it falls
lower than the edge of the cornea, and goes
entirely out of fight : and, in attempting to extract
the chryftalline lens, if the iris is wounded, red
blood comes from it, and there is a great rednefs
and inflammation of the part. Hence it is certain
that thefe veffels convey the red blood in life,
but the red colour of the veffels is concealed from
us by that paint or colour which is laid over them,
and the aqueous humour is probably fecreted from
the veffels of the iris.

CCVI.

The principal ufe of that coat is to exclude a fuperfluous quantity of light, and to allow as much as is ufeful to reach the retina; hence, when the eye is turned towards the light, the pupil is fmaller; and when it is turned from the light, it becomes larger, adapting itfelf to the quantity of light. But there is fomething more than that happens; it is not merely affected by the general quantity of light, but it is contracted or widened wherever objects become indiftinct, by being placed too near the eye; thus it contracts if the object is indiftinct; and turning the eye downwards, the pupil gets a certain diameter; but, if the point of a fmall pin is brought near the eye, the iris, though not now folicited by more light, contracts a little more than before to fee it diftinctly. Thus if there is a fmall hole made in a bit of paper, and there is brought to it a fmall printed book which appears confufed, when viewed through the hole it appears more diftinct, and this experiment enables us more readily to receive the fact, that we diftinguifh the motion of the iris in viewing near objects.

CCVII.

This circumftance refpecting the pupil is of the utmoft confequence to attend to in judging of difeafes. When the eye is infenfible to the light, there is a very fmall degree of motion in the iris;

and it is the same whether the eye be less sensible to receive the impression, as in the gutta serena; or is less sensibly impressed by the light being intercepted, as in the cataract: in both cases the pupil becomes larger.

CCVIII.

Some have supposed that the motion of the eye was owing to the light striking the iris, and affecting it; but it evidently depends upon the manner in which the retina is affected; for the pupil loses its motion nearly as much in the cataract as in the gutta serena, or the two eyes sympathize: suppose one eye is diseased, and that the pupil is little affected by imitating it; yet, upon opening the sound eye, the irritation upon the one affects the pupil of the other, so the motion depends upon the affection of the retina.

CCIX.

Besides the circumstance of the eye adapting itself to the confusion of objects, shews an instructive power, which is more extensive than we are commonly aware of. We not merely contract the pupil, and allow it to relax itself by its natural tone, but we possess a muscular structure; not one that can be shewn by dissection; indeed, we cannot shew a spincter for contraction, or fibres for dilatation, but we possess the power of contracting or dilating the iris beyond its tone. The contraction is known from the common effect of light;

but wherever the retina is uncommonly infenfible, by difeafe, the pupil is widened far beyond its natural tone; and, in perfons dying, the pupil is feen much larger than it was five minutes after death, which brings it nearly to the fame fize as when the eye is not turned to a very clear light, nor in too great obfcurity. But in the hydrocephalus and amaurofis it is greatly dilated. When the patient is aroufed by giving him hart-fhorn drops, &c. the pupils are greatly dilated; and when the ftimulus is made by light, upon bringing the candle near the eye, the pupil opens fo wide that the colour of the iris is fcarcely to be diftinguifhed. It has been accounted for from mechanical irritation; but when the patient is roufed, there is an effort made to fee; the quantity of light is not fufficient to make an impreffion; therefore, by an inftinct of nature, there is an effort to enlarge the pupil; and immediately after death it contracts to a much fmaller fize than it appears in thefe difeafes.

CCX.

Cornea and Sclerotis.

It remains to confider the external coats, the cornea and fclerotis. Whilft the cornea ferves the fame purpofe, by its pellucidity it tranfmits, and by its roundnefs it collects, the light; for the light is in a great meafure collected before it reaches the lens, that it may be accurately regulated by a

smaller motion; the light is brought into a very
small pencil of rays, so that the iris, by a very
small motion, exactly regulates what is neceſſary.
The eye is supported in its place by the tunica
adnata vel conjunctiva, which is produced from
the eye lids doubled; and we trace it over the
eye, even making a part of the outer layer of the
cornea, though it is not ſeparable by diſſection,
but it is laid more loofely over the sclerotic coat,
and many veſſels run here, so it is ſubject to in-
flammation, which often extends over the whole
eye, and the whole very ſenſible ſubſtance of the
a is covered with veſſels, and we often find
produced upon it. Where the veſſels are
very deep, there may be a dilation of the natural
veſſels; but in 99 cafes of 100 they are a new
growth, beginning in the sclerotic coat, and gra-
dually extending over the cornea, as in the cafe
of a loſs of ſubſtance or wound; and we may
trace them with the eye over the coat, and theſe
arteries meet again with veins to return the blood.

CCXL.

The tears next are conducted to the puncta la-
chrymalia, and paſs down into the nofe, where
they are poured out under the inferior os ſpon-
giofum. But, by what power are they taken up,
and thus conveyed to the nofe?

CCXII.

The puncta have open mouths, which are supported by a ring of hard cartilaginous matter, and the ducts gradually enlarge, and end in the lacrymal one. It is evident that the tears are not pushed into the puncta by force, for preffure makes them run over the cheek; fo they muft be fucked in by that power inherent in fmall capillary tubes; and they are thus conveyed a certain way. We fhall fuppofe that this power is fufficient to fill the ducts altogether; that the whole fac and ducts are filled by attraction, which is, perhaps, not true. We cannot fuppofe the motion continued; it does not empty thefe again; for, fuppofing the fupply cut off, the duct remains full, becaufe the fame power that draws the tears into the ducts, if no more tears are added, prevents the emptying. There is an attraction that would fufpend the tears within the ducts; but, if more fluid is added, it comes to reprefent the common fyphon in its operation, and there muft be a mufcular power in the holes to pufh on the liquor.

CCXIII.

From this view of the general ftructure of the eye, it appears that its firft coat, or tunica adnata, connects the eye by its thin pellucid membrane to the orbit, and protects it from the irritation of extraneous bodies. Its next coat, or the cornea, hard and denfe, forms its anterior covering, is

more convex than the reft of the ball, and is
joined to the fclerotica as the fegment of a fmall
fphere to that of a larger one, containing the
aqueous humour within its membrane. The con-
vex iris compofes a tranfverfe feptum, floating in
the aqueous humour between the cornea and fcle-
rotica, with a middle perforation for the pupil.
The iris, on its back part, difplays a dark coloured
pigment, termed the uvea; on removal of which,
its ftructure confifts of two fets of fibres; one
radiated, of various colours, and giving the parti-
cular colour to the eye; the other circular, and
forming the fpincter mufcle of the pupil, which
regulates its motions as influenced by the impref-
fion of light made upon the retina. The fclerotic,
the next coat, is firmly fixed to the edge of the
cornea, and is the moft extended and ftrongeft
membrane of the eye, with fibres running in every
direction. Its inner furface is in contact with the
choroid coat, the connection being formed by
veffels, nerves, and cellular fubftance. This thin
coat, entirely vafcular, is of a dufky brown colour,
having on its infide a dark coloured mucus or
pigment, which gradually difappears, or becomes
lighter in its courfe towards the optic nerve. The
connection of this coat at its fore part, and the
former, and alfo of the iris, is made by condenfed
cellular fubftance in the form of a fhining cord,
termed the ciliary ligament or circle, oppofite to

which is a black radiated ring, confifting of ciliary plicæ, or proceffes, and ftriæ, named the corpus ciliate, and compofed of the continuation of the veffels of the choroid coat. The optic nerve in its courfe through the orbit, is covered by its membranes from the brain, but after its ingrefs through the fclerotic coat, it expands to form the retina. The retina is a tender pulpy fubftance, femi-tranfparent, and of a light grey colour, varying in its equality and thicknefs, in different parts advancing between the choroid coat and capfule of the vitreous humour to the fore part of the eye, and terminating upon the anterior edge of the chryftalline lens.

CCXIV.

Of the humours, the aqueous is lodged in two chambers or cavities. The anterior is fituated between the cornea and iris, and the pofterior between the iris and chryftalline lens. The chryftalline lens placed behind the aqueous humour, is oppofite to the pupil, and lodged in a depreffion on the fore part of the vitreous humour. It refembles, as already noticed, a burning glafs. It varies in figure and colour at different periods of life, is compofed of concentric lamellæ placed over each other, and the firmnefs of its fubftance increafes as it advances to the centre. It is furrounded by its proper capfule, or covering, which is fo elaftic that its puncture readily allows the

disengagement of the lens. The vitreous humour fills the space from the chryſtalline lens to the entrance of the optic nerve at the bottom of the orbit, and is concave before and convex behind. Its ſpace is equal to $\frac{9}{10}$ of the eye. Its ſtructure conſiſts of delicate cells communicating with each other, including the liquor; and on its furface there is a tranſparent ſmooth coat, termed vitrea. To the vitreous humour the lens is fixed by an external circular lamina, inſerted into the fore part of its capſule, termed the zonula ciliaris.

CCXV.

While the aqueous humour is on evacuation eaſily renewed, and while the chryſtalline lens can be alſo diſplaced, and viſion preſerved, the loſs of the vitreous humour is inſeparable from the functions of the eye, and cannot at any time be renewed.

CCXVI.

To conclude our demonſtration of the eye, its circulation ſtill remains. This it derives from the carotids. The lids are ſupplied by the frontal, faſcial, and temporal arteries; and theſe arteries again communicate with thoſe within the orbit.

CCXVII.

The ocular, or ophthalmic artery, paſſes through the optic hole along with the nerve; and though in ſize no bigger than a crow quill, from it a con-ſiderable number of arteries ariſe, for it ſupplies

not only the eye itfelf, but all the appendages of
the organ. Thus, it firft fends a branch which
takes its courfe outwards and inwards along the
eye to fupply the lacrymal gland, where it is
exhaufted. It next gives circulation to the organ
itfelf, by means of a branch perforating the optic
nerve, and diftributed upon it; and alfo by means
of the ciliary arteries, which go inwards to the
fore part of the eye, where the ciliary circle lies.
It then fupplies the mufcles by means of an
artery proceeding from the fame fituation as the
ciliary. Two arteries then pafs from the focket
through the ethmoid bone to the nofe; and, laftly,
the branches which are fpread on the forehead
and nofe proceed directly from the ophthalmic
trunk.

CCXVIII.

With thefe arteries, as elfewhere, the veins
correfpond; and they, at the fame time, commu-
nicate partly with each other, and pafs partly to
the external jugular vein and branches fituated
about the fore part of the orbit, and partly to the
internal jugular vein of the cavernous finus.

CCXIX.

That the eye may properly execute its func-
tions, it is neceffary that the rays of light be fully
collected on the retina, and meet in one point or
focus; and to effect this, a due convexity of the
cornea and lens muft always take place. When

too great prominence prevails, the rays become too foon collected, and vision is indistinct from this cause, or people are short-sighted. Where an excess of flatness is conspicuous, the reverse of this ensues, and only an indistinct focus is formed, as in the cafe of age. The motions of the iris and the muscles of the eye, regulating the presence of light, and determining by their action the length of its axis, enable the organ to accommodate itself to the distance of objects.

CCXX.

Chemical Analysis of the Cranial Secretion.

The thin vapor or fluid contained between the dura and pia mater, and also in the ventricles of the brain, feem in its constituent principles to be composed of carbonated hydrogen gas and water.

Vascular Preparation of the Head.

In order to shew the circulation of the head, the latter should be separated from the body about the 6th or 7th vertebra. A pipe is then to be fixed in each carotid artery, or they may be both injected at the fame time, and the injection should be red. The jugular veins are also to be filled in the fame manner, with a yellow injection, the cervical vessels being previously fecured by ligature, to prevent its escape.

When the injection is finished, a part of the jaw bone must be removed to shew the course of the internal carotids, and it should be behind the last molar teeth. On one side, the muscles should be dissected away between the cervical vertebræ to shew the course of the

veſſels; and, on the other ſide, they ſhould be only cleared of fat and cellular ſubſtance.

The external view being thus ſecured, ſections are to be made of the ſummit of the cranium to ſhew the internal parts, and that in various ways, according to the purpoſe intended by the anatomiſt. A ſaw muſt be uſed to accompliſh this, and the membranes, on removal of the bone, are to be divided by a knife or ſciſſars.

Chemical Analyſis of the Eye.

The quantity of the aqueous humour is 4 or 5 grains, but it varies in different caſes; by ſmell in the fœtus, in age, and in dying; but it is more quickly repaired when deſtroyed, than any other fluid in the body. Its principles conſiſt of water with animal hydrogen gas, and ſometimes a ſmall proportion of ſoda, and muriat of ſoda.

The chryſtalline lens, in gravity, is equal to 4 grains. By its maceration in ſpirit of wine, or vinegar, it ſeparates laminæ like the leaves of a book, ſeparable from each other by a ſcalpel. In acids it is rendered opake, and condenſed by congelation.

The vitreous humour is heavier than common water, and bears a proportion to more than two thirds of the weight of the eye. It reſembles a ſingular ſpecies of tremulous jelly. It is rendered turbid by moſt other ſalts but the acetous acid.

The pigment, or coloured mucus of the iris, differs in its two ſurfaces. In the poſterior ſurface it is always black, but in the anterior it is various. In cold countries it is bluiſh, or of a pale aſh colour. In warm

regions it is of a dark chefnut or black hue, and various fhades are fometimes obfervable in different parts of the fame eye.

The conftituent principle of this pigment is animal mucus, mixt with a peculiar colouring matter.

The pigment of the choroid membrane is of the fame nature, and anfwers the fame purpofe.

The tears, or lacrymal fecretion, is an aqueous liquor, faltifh to the tafte, and in quantity only moiftening the eye, but capable of being increafed to great extent from any irritation or ftimulus applied to the organ, fo as to overflow the eye, and pafs down by the cheek.

The conftituent principles of this fecretion are;

1. Water, in great proportion.

2. A peculiar kind of mucilage.

3. Muriat of foda, phofphate of lime and of foda, and foda in a cauftic ftate.

Hence their infpiffation by the abforption of oxygen from the atmofphere.

The fecretion of the eyelids is an oleaginous mucus, not foluble in water, and infpiffated by the oxygen of the atmofphere. When mixed with the tears, it forms a kind of glue, cementing the lids together.

The mucus of the caruncula lacrymalis and lacrymal fac, is of the fame nature.

CCXXI.

After having feen the brain, and its expanfions on the eye, we are next to purfue its different prolongations as they proceed from the cranium, and conftitute the nerves.

CCXXII.

The firſt pair is called the olefactory; it paſſes through the cribriform bone, and is divided into a number of ſmall branches without receiving any firm covering from the dura mater; and the ethmoid bone, within the nofe, is compoſed of a number of cells, that the nerve may be divided as much as poſſible, becauſe there muſt be a certain diviſion of parts before the ſenſation can take place, as in the eye, where the nerve is infenfible at its entrance.

CCXXIII.

Next, we fee the optic nerve united; the nature of the union has been already explained, that the threads actually decuſſate one another. This connexion has been ſuppoſed to account for the uniform motion of the eyes; but we need only to obſerve that the optic nerve, does not terminate on the organs for the motion of the eyes, it is merely a nerve for ſenſation. When we proceed to trace the optic nerve, we fee the medullary fubſtance ſpread out into an uniform coat, and there is no reaſon to imagine any kind of motion has been inferred.

CCXXIV.

In this foft and fine fubſtance called the retina, the nerve muſt be ſpread out, and it terminates in

exceeding minute parts. From the fmallnefs of the picture we would infer, that the diameter of one of the threads does not exceed the twenty thoufandth part of an inch, fuppofing that the picture occupies but a fingle thread; but the probability is, that a number of the threads are affected by every picture at the fame time; we fee, ·therefore, that there may be numerous nerves diftributed to parts, though we are not able to trace them.

CCXXV.

The third pair of nerves is called oculi motor, fupplying many of the mufcles of the eye; we find likewife produced from that nerve fmall threads, which join to fupply the iris.

CCXXVI.

The next pair, the fourth, is fingular in every circumftance. In its origin, which is very diftinct from the teftes, and from the origin of the third pair, which is a nerve of the brain, and the other of the cerebellum, and it terminates in a fingle mufcle, the trochlearis. Some think that it is the chief inftrument of expreffing the paffions of the eye, fo it receives a thread undivided; but obferve only the diftribution of the third pair. We find a mufcle co-operating fupplied by a common root, and the third fupplies the attollens and deprimens oculi, which are antagonifts, fo we would

leave this as a circumſtance that we cannot ex-
plain.   Where nature is uniform, the diſtribution
is intended for ſome wiſe purpoſe; but in the
preſent inſtance that lies concealed.

CCXXVII.

The fifth is the largeſt nerve of the cranium,
and is ſoon ſpread out into a conſiderable branch,
which is ſeparated into three diviſions.   The firſt
and ſecond ſend ſome branches into the noſe, and
other branches ſupply muſcles, ſo it ſerves both
for motion and likewiſe for ſenſation; and the
third branch ſerves not only for ſenſation on the
point of the tongue, but taking its courſe towards
that point, it ſupplies the muſcles of that organ,
and branches are ſent to the maxillary and ſub-
lingual glands, to regulate the ſecretion of the
ſaliva.   Now, though certain nerves, as the ole-
factory and ophthalmic, have a greater whiteneſs
than we obſerve in the other nerves; yet, in the
fifth pair, the branches ſupplying the ſenſes have
the ſame colour as thoſe deſtined for motion, and
hence we conclude that all its offices are per-
formed by the ſame medium.   Thoſe nerves in-
tended for more diſtant parts are expoſed to in-
jury, and receive, perhaps, an addition of the ner-
vous influence from the coats that cover the proper
nerves.

CCXXVIII.

* When we now look back to the origin of the five first pairs, we find that the first, second, and third pairs are nerves of the brain, whereas the fourth and fifth are almost entirely derived from the cerebellum, yet similar offices are done by both. The first and second are organs of sense, the third of motion, the fourth of motion, the fifth of sense, motion, and for assisting in regulating the secretions; so that there is no reason for imagining that the offices of the brain and cerebellum are so very different as some physiologists have pretended.

CCXXIX.

The fifth joins the third, forming a small ganglion. The only remark to be made upon it is, that we see ganglions in these parts which serve the most material purposes.

CCXXX.

The sixth pair is spent upon the abductor muscle, for a reason we do not pretend to understand, why the third might not have furnished the abductor as well as the other recti.

CCXXXI.

In its course, we perceive the connection made by two distinct threads which form the beginning of the intercostals; for it is absurd the dispute about the course of these, whether it is upwards

or downwards, whether they come from or go to this nerve. If they come from the intercoftals, we have no origin to that nerve; befides, we conftantly obferve that the fixth pair becomes fmaller betwixt this place and the eye; fo thefe, with the branches from the fifth pair, are the higheft origins of the intercoftal or fympathetic nerves.

CCXXXII.

The feventh is divided into two portions, one of which is without a covering, becaufe it i. in no danger of being tore, and is called the portio mollis of the auditory nerve; but the other branch, running outwards, receives the covering from the dura mater, and is called the portio dura. And as we have found more than one nerve fupplying material organs, the portio dura is joined by a branch from the fecond of the fifth, and we find a nerve connecting it to the fecond and fifth; and there is no doubt with regard to the chordæ tympani, that they are from the portio dura; and that the point of the tongue is fupplied by the fifth in two places joined to the feventh; fo that care is taken that we may not want the fenfation of the tongue.

CCXXXIII.

Purfuing the portio dura, we find a very great number of branches fpent upon the face. We may venture to allege, that the number is greatel

here, in proportion, than what is spent upon the other muscles, because the muscles of the face perform a double office; they not only serve for the motion of the lips, but for expressing our passions; and our nerves are large in proportion to the exercise of the motions of the organ in which they terminate.

CCXXXIV.

The portio dura is joined to other nerves; but the branches, instead of forming continued canals, pass over each other; and where a muscle is supplied, it receives a thread from each of the nerves: so we find a greater care taken to prevent these from losing their power than most of the other muscles, because of the importance of their office. Thus, if we can open and shut the mouth with half the natural force, it is better than that we can open and not shut it.

CCXXXV.

The next pair going very far downwards, is named par vagum. It supplies the larynx; and as the function of that organ is material to life, so every precaution is taken to guard against accidents; hence there is a superior linguæ, and a recurrent sent back in a very particular manner. And, in endeavouring to determine the final cause, it is found that the voice is not lost by cutting one of the nerves, though the recurrent. The

feveral tones, indeed, and the general ftrength of the voice is diminifhed, but it is by no means loft.

CCXXXVI.

The ninth pair, like the fifth, fupplies firft the mufcles, and then the organs of fenfe, and like-wife the fecretions; for from the furface of the tongue there is a confiderable fecretion of mucus.

CCXXXVII.

Nofe.

In this diftribution of the nerves, we find the fift pair diftributed on the nofe.

This organ confifts of two parts, a hard and foft one. The hard part, or bony ftructure, was formerly examined; and, at its under and fore part it confifts of five cartilages, of which one is fituated in the middle, and the other four laterally.

The middle one fupports the reft, and confti-tutes the feptum, or divifion of the noftrils.

CCXXXVIII.

The lateral cartilages are placed two anteriorly, forming by their curved union the top of the nofe; and two behind, which compofe the alæ nafi, and between thefe are fmaller ones of various fize and figure. Thefe cartilages are moved in different directions by the mufcles formerly defcribed, and over the whole is thrown the common tegument, which are perforated at the under and outer part by large febaceous glands.

CCXXXIX.

The internal cavities of the nofe extend up-wards to the cribriform plate of the ethmoid, and to the body of the fphenoid bone. They are bounded by the middle partition, partly of bone, and partly of cartilage; and, on the outfide, the fpongy bones project into them, and increafe the furface of the membiane.

CCXL.

The bottom of the noftrils runs ftraight back-wards, admitting the paffage of a probe into the throat, and the fore part is defended by ftiff hairs which detain the mucus, and prevent the entrance of external irritation.

CCXLI.

The cavity of each noftril has been divided into three paffages, a fuperior, middle, and inferior one. The firft afcends to the upper fpongy bones, the fecond to the junction of the fuperior and inferior fpongy bones, and the third from the termination of the inferior ones to the bottom of the nofe.

CCXLII.

Thefe cavities are every where lined with a thick fpongy membrane, which is continued like-wife over all the adjacent parts, which is highly vafcular and nervous, and conftitutes the primary organ of fmell, having its furface kept conftantly moift and lubricated, with a mucous fecretion from its numerous follicles.

In this cavity of the nofe all the finufes of the cranial bones terminate, and the fame covering extends over them as extends over the nofe, but it is thinner and lefs vafcular. This termination of the cranial finufes feems particularly intended to increafe and modulate the voice.

CCXLIII.

In this cavity of the nofe likewife terminates the lacrymal fac and incifive duct. The firft was already noticed in the Ofteology. It is a membranous canal, the duct of which ends in the inner and fore part of the antrum maxillare. The fecond is a fmall canal, or paffage in the foramen incifivum, which is not only open in the fkeleton, but in the natural ftate of the body, though in many fubjects it is entirely fhut. Its office is to convey the tears from the nofe into the mouth; for the tears dropping from the lacrymal duct, when the head is in an erect pofture, fall into that canal.

CCLXIV.

The circulation of the nofe is fupplied chiefly from the branches of the external carotids. The outer part receives certain divifions of the facial, and of the internal maxillary arteries, while the inner draws its circulation from the internal maxillary artery, and fmall branches of the ocular arteries. Its veins again terminate in two ways, either in the external jugulars, or by communi-

cating with the ocular veins, their circulation passes into the lateral sinuses and internal jugulars.

CCXLV.

The nerves of this organ, or of the internal part of the nose, are principally the olefactory, or *1ft* pair, affisted by some branches from the *1ft* or *2d* portions of the *5th* pair, while the outer surface draws its feeling not entirely from the same source, but from the *2d* branch of the *5th*, and from the portia dura of the *7th* pair.

CCXLVI.

Chemical Analysis of the Nasal Secretion.

The quantity of this secretion is very various; when thin, it is pellucid; but when thick, it is otherwise, and mixt with various matters. In confistence it is vifcid and ropy, adhering to all bodies. It is mixed more or less with two other excretions, an aqueous fluid from the sinufes, and the lacrymal fluid. At its first fecretion it appears analogous to the tears, but it changes by its stay in the nose, abforbing probably oxygen from the air, and having the carbonic acid of the expired air faturating its uncombined soda. Of all the animal fluids, it is the least subject to putridity, and it may be kept for any length of time without producing any foetor.

CCXLVII.

From the demonstration of the nose, we are directed naturally to that of the mouth, the offeous and mufcular parts of which have been already described.

CCXLVIII.

Mouth.

We begin, therefore, with the lips and cheeks, which, befides their mufcles, confift only of the external teguments and the internal covering, lined with mucous glands.

CCXLIX.

This membrane is covered with fine villi, moft confpicuous on the edge of the lips, efpecially by a fine injection, or by macerating them till the feparation of thé cuticle. On entering the mouth; the gums next appear as formerly defcribed, (Vol. I. CCV.); and, on leaving them, we are next directed to the palate and tongue.

CCL.

Palate.

The palate confifts of two parts, the bones already demonftrated (Vol. I. LXXXVI.) covered by the perioftæum and villous membrane of the mouth, diftinguifhed here by numerous rugæ, intended to affift the divifion of the food, and to increafe the force of its preffure againft this part in order to extend the powers of tafte, and the foft parts, or velum, forming a partition between the mouth as · formerly defcribed, (Vol. I. CCCXXII., &c.) and compofed of the membranes which line thefe parts befet with mucous glands, and its own mufcular expanfions which enable it to act in fwallowing, as a valve, on the nofe. From this part,

we alfo fee its uvula or pap defcend, a part of
material ufe in deglutition and fpeech.

CCLI.
Tongue.

The tongue, the next object of our attention,
is of an oval form, and divided into three parts,
its bafe, its body, and its apex; and the compo-
fition of this organ, except its membrane and pa-
pillæ, confifts entirely of mufcles, already demon-
ftrated (Vol. I. CCCXXXV. &c.). The bafe of
the tongue is connected, as we have feen, to the
os hyoides (Vol. I. CCXCVIII.) and its body
terminates anteriorly in the loofe moveable point
Its upper furface is divided by a middle longitudinal
groove; and its inferior furface, fo far as it extends
backwards, is connected to tne parts below by
the fublingual ligament, or doubling of the fkin
lining the mouth.   Membranous ligaments attach
its fides to the lower jaw and adjacent parts.

CCLII.

The coverings of the tongue are three in num-
ber: the common teguments, kept moift by the
faliva, and formed alfo into vaginæ for the pa-
pillæ; the corpus mucofum, thicker here than any
where elfe, but alfo preferved in a moift ftate;
and the true fkin, of a bright nervous texture,
from which the papillæ of the organ proceed.

CCLIII.

Thefe papillæ are confined to the upper furface

f the tongue, and are moſt numerous over its apex. They are divided, from their ſize, into three orders. The 1ſt are largeſt, have round heads and ſhort ſtems. They are placed more at its baſe in ſuperficial pits, and form, as it were, an angle with its point backwards; their ſecretion is of a ſalivary nature, proceeding from a perforation in the middle of each. Beſides theſe papillæ, numerous mucous follicles cover the ſurface of the tongue. At its root, alſo, there is a hole, which receives the mouths of ſeveral excretory c^ s terminating upon it.

CCLIV

The 2d order of papillæ is of a cylindrical form, and en in a round extremity, being ſcattered ove. he upper ſurface of the tongue, at ſome diſta e from e other.

CCLV.

The 3d order is numerous and minute, extending over the apex; and to the former and this the impreſſion of taſte is chiefly aſcribed

CCLVI.

The circulation of the palate is derived from branches of the facial, and internal maxillary artery, while its veins are directed to the external and internal jugulars.

CCLVII.

The circulation of the tongue is ſupplied from the external carotids, and the branches they be-

flow for this purpofe are termed linguales, or, from their black colour under the tongue, raninæ. In proportion to the fize of the organ, its veffels are apparently large; and they have lefs communication with each other in the oppofite fides than in other parts of the body.

CCLVIII.

The nerves of the palate arife from the 2d portion of the 6th pair, with fome twigs of the 8th.

CCLIX.

Thofe of the tongue are from the 5th, 8th, and 9th pairs. They are large in the fame proportion as the veffels; and they have, likewife, little connection on the oppofite fides.

CCLX.

To finifh the demonftration of the mouth, its glands remain, which are three in number: the parotid, the fubmaxillary, and fublingual; all of a yellow colour, and of the conglomerate kind.

CCLXI.

The parotid is a large gland, named from its particular fituation, and it occupies the fpace between the ear, maftoid procefs, and angle of the lower jaw, extending to the zygoma and maffeter mufcle, which it partly covers, and lying contiguous below to the fubmaxillary gland.

CCLXII.

From different parts it gives out fmall branches, which join in a large duct paffing from the upper

and fore part of the gland; and the cavity of the gland is fmall, proportioned to the fize of this duct.

CCLXIII.

In it's progrefs, it paffes tranfverfely over the maffeter tendon, where it receives fome additional ducts from fmaller glands; and defcending, it perforates the buccinator mufcle, oppofite to the 2*d* or 3*d* upper molaris.

CCLXIV.

The fubmaxillary gland, rounder and fmaller than the former, lies between the angles of the lower jaw and the digaftric mufcles. From its upper and fore part arifes a duct, thinner and longer than the former, which paffing to the fide of the frænum linguæ, terminates by a fmall papillary orifice behind the incifors.

CCLXV.

The fublingual gland, oval and flat, is alfo fmaller and fofter than the laft. It is fituated under the anterior portion of the tongue, with its extremities forwards and backwards. It is covered by a continuation of the lingual membrane, fixing it in its place, and it opens on the outfide of the frænum by feveral fmall orifices on a line with the gums. It fometimes communicates by a branch with the fubmaxillary ducts.

CCLXVI.

Befides the glands defcribed, a number of fmall

ones are confpicuous on the infide of the mouth, fituated between its inner membrane and the mufcles; and each of thefe perforate its cavity by a fmall duct.

CCLXVII.

The circulation of the falivary glands is fupplied by the external carotids. The parotid derives its fupply from the temporal artery, the fubmaxillary from the facial, and the fublingual from the lingual artery, while their veins are returned to the external jugulars.

CCLXVIII.

The origin of their nerves is traced from the 3*d* part of the 5*th* pair, and from the portio dura of the 7*th*.

CCLXIX.

By thefe glands is the fecretion of faliva made and poured out by their ducts in large quantity for the folution of the food, lubricating the parts, and affifting digeftion.

CCLXX.

Chemical Analyfis of the Saliva.

The fecretion from the falivary glands is one of the moft important to the animal economy. It is not lefs than to the amount of 12 lbs. in 12 hours, and it is confiderably augmented either by irritation of the parts, as in maftication, or fpeaking, or by hunger.

The conftituent principles of the faliva are;

1. Water, to the amount of $\frac{3}{4}$.

2. Albumen, diffolved in the water.

3. Compound falts, confifting of muriat of foda and phofphate of lime, as occafional concretions in the ducts fhew.

Saliva poffeffes an antifeptic virtue, it promotes the fpiritous fermentation of vegetable matter, it is diffolved by alkalis, and it gives out, during the folution, ammonia.

Anatomical Preparation of the Parotid.

This gland fhould be injected in its place from its numerous fmall branches. To do this, the fkin fhould be raifed on the fide of the face from the ear to the mouth, and from the temporal mufcle to the neck, and in doing it the knife fhould be kept clofe to the fkin fo as to avoid the gland, and the fat and cellular membrane diffected with much care from the maffeter mufcle to find the duct about 2 inches long, and refembling in fize a crow quill. An opening is to be made into it with the point of a lancet, fo as to introduce the point of the fteel injecting pipe as far from the gland as poffible; which, once introduced, is to be fecured by a ligature with one knot. When the gland has received as much quickfilver as it can contain, the pipe is withdrawn, and the duct fecured by ligature, after which it is to be carefully diffected from its place, firft fecuring its numerous branches by a fmall needle and ligature before dividing them. The gland removed is to be laid in a difh, the extraneous parts about it removed, then laid in clean water for a day or two, after which it is to be fpread on pafteboard and placed in the air to dry, after which it may be preferved in a glafs veffel with oil of turpentine.

CCLXXI.

Having thus seen the ftructure of the nofe, mouth, and tongue, let us examine the ufe of thefe parts, and the reafons of their ftructure, beginning with the fenfe which is exercifed in the moft fimple manner.

CCLXXII.

Tafte.

Very large arteries and nerves are obferved to be fent to the tongue, which is neceffary from the tongue being an organ of very confiderable motion, and from exercifing the fenfe of tafte; befides which, from its furface there is a confiderable fecretion; for to the laft purpofe a great quantity of blood is effential: but a quantity of blood is likewife conftantly found circulating in organs that perform a large motion, and ftill more in organs of fenfe. The reafon of this, at firft fight, is not fo certainly evident; but there is reafon to believe, that as the heart and brain act upon each other in a circle, we find ourfelves at a lofs to diftinguifh caufe from effect; in like manner the arteries and nerves, in their progrefs, act upon each other. And there is further reafon for believing that, in a manner not fully underftood, the arteries tone the nerves for receiving their impreffions, and conveying them diftinctly. When we compare the tongue with the nofe, we fee this in a clear point of view.

In the membrane of the nose, there are such a great number of vessels that circulate red blood, that we should be apt to imagine that these would prevent the distinct impression of the nerves; but, on the contrary, they contribute to increase the distinctness of it; and in making experiments with medicines, how far they act by immediately influencing the nerves, this is apparent. Thus, after the circulation is interrupted in the course of the nerves, as the sciatic, though the organ is quite entire, medicines cannot influence the system through that single branch after the circulation has ceased, though they produce the most violent symptoms when applied to the corresponding nerve where the circulation is carried on; so that the arteries actuate the nerves in their progress something more than merely by giving them a certain degree of tension; and, in like manner as we find the arteries assist the nerves in their office of sense and motion, the nerves assist the arteries in performing their secretions. Hence it may be alleged, that the numerous nerves of the tongue not only are intended for motion and sense, but for regulating the secretions made from the extremities of the arteries.

CCLXXIII.

In exercising the sense of taste, we apply saline substances, which are divided upon the surface of the tongue ; and, if we do not perceive the im-

preffion, we prefs the tongue againft the palate;
not that the palate is the principal organ of tafte,
for, upon rubbing the body of the tongue againft
the palate, we have no diftinct impreffion, but
the effect is to make the greater impreffion upon
the tongue: whether the feveral papillæ are ren-
dered more fenfible, is uncertain. The fwelling
of the papillæ of the tongue, upon irritating them,
has been obferved by fome; and there is probably
a filling of the veffels in order to give a greater
fenfibility to the part.

CCLXXIV.

The noftrils are alfo fituated, that we may fmell
fubftances at the fame time that we tafte them;
and they do not receive the current of the atmo-
fphere, but the current of air afcending from the
roof of the mouth.   When the air enters the
nofe, inftead of running in the moft direct man-
ner into the throat, it rifes upwards to the top of
the nofe, to the offa fpongiofa, which are the
principal part of the organ of fmell; for, upon
examining a variety of animals, the acutenefs of
fmell varies with the extent of the furface of thefe
bones; and, in a dog, they are extremely con-
voluted; and from thence we underftand the rea-
fon of the name of turbinatum.

CCLXXV.

But is it to be imagined that the finufes, or
larger caverns that communicate with the nofe,

contribute to increafe the furface of the organ of
fmell? or is it to be faid that the membrane lining
the finufes fupplies the moifture to the nofe, to pre-
vent it from being dried by the current of the air?
We do not fee that the finufes are neceffary in
order to fupply a fufficient quantity of moifture;
for if, in infpiring, a great deal of moifture is
carried away, at the next moment, when we ex-
pire by the fame paffage, we not only return
through the nofe all that we took from it, but the
addition of the vapour brought from the lungs.

CCLXXVI.

Some of the finufes, alfo, have the opening at
the top. If thefe were filled with moifture when
we are fome time in an erect pofture, upon bring-
ing the head forwards we fhould fee it difcharged;
and the finufes being filled with water, would
counteract one of the main purpofes of the finufes,
the effect they have upon the voice. And with
no better reafon are they fuppofed to extend to
the organ of fmell, for children fmell as acutely as
adults, and yet in them the finufes are only be-
ginning to form. It is ufe that, in a great meafure,
extends them continually as they advance in life.
There is, no doubt, a difpofition in the bone to en-
large; but they are increafed by ufe. And this con-
fideration, alfo affords an argument againft their
being intended to fupply the nofe with moifture,
for children have rather more moifture than adults,

though the finufes are only beginning to form. Befides, comparing a variety of animals, the appearance of the finufes does not vary with the acutenefs of the fmell; but the variation is within the open cavity of the nofe. On attending, alfo, to what happens in ourfelves, the openings are not moft favourable for receiving the air in infpiration, when we fmell moft acutely; and if the membrane of the finufes feels very acutely in drawing in a pungent fubftance, we fhould be fenfible of pain in this as well as in the nofe; for it has been alleged, that we do feel pain in the root of the nofe; but whether is it in the os fpongiofum fuperius, or in the ethmoid bone, or a little higher? The pain evidently does not extend further than the root of the nofe, and never above the eye; and the antra maxillaria are extremely large, and yet we never find a violent pain in the cheeks in drawing in odours into the nofe; and, as an irrefiftible argument, it may be obferved, that in the time of infpiration, or fmelling, the air does not enter the finufes, but comes out of them. A fmall ftream from the finufes entering the lungs along with the external air, (the air in the lungs being now lighter than from the finufes,) enters them for the fame reafon the external air does. And if we find fmall particles of duft within the finufes, thefe are pufhed in from the open cavity in the

time of expiration, the air rushing where there is a vent, endeavouring to expand on all sides, it enters the sinuses.

CCLXXVII.

It is therefore to be said, that the membrane being thin, and the bones hard, such a tremor is produced as renders the voice louder, and more harmonious. The use of sinuses may be, indeed, confined to this last purpose; and that they serve this purpose, appears from a variety of considerations. The voice is formed at a certain age, as the sinuses form; and we find, that when the membrane of the nose is thickened, the voice becomes harsh and disagreeable. Or, comparing the sinuses with a drum, we find a great analogy between them. Take the antrum maxillare, there is an impression made on the side of it, and it is shut by membranes resembling the parchment of the drum, and the opening in that instrument. And apply the finger to it in the time of speaking, you will be sensible that all the bones are at that instant under a tremor.

CCLXXVIII.

The last part of the head that awaits our examination is the ear.

CCLXXIX.

Ear.

The skin of the external ear, or ala, is supported by cartilage. It is divided, at its fore

part, into several cavities; and, besides the muscles connected with the head, the superior attollens aurem, &c. there are a few very short and very pale coloured muscular fibres, which begin and end on the external ear, and which are already demonstrated (Vol. I. CCCXXXV).

CCLXXX.

Of the ala, the outer bar, or margin, is termed the helix, from it's bending direction; and it divides the concha into two parts. The inner bar, or margin, termed the antihelix, consists of two ridges, placed within the former, that unite below. Over the external passage is a small eminence, the tragus, connected to the under and fore-part of the helix, and is distinguished by the hairs that grow on it. Opposite to this is the antitragus, then the namelefs cavity situated between the helix and antihelix, next the scapha, or boat-like part, between the limbs of the antihelix, and following that is the concha, or cavity under the antihelix, the inferior part of which leads to the meatus auditorius.

CCLXXXI.

From this part there is a passage inwards, the outer half of which is composed of the same materials as the external ear; but the inner half, in the adult, is osseous. In a child, the whole passage is soft or cartilaginous, and the bone only by degrees encroaches upon the cartilage.

CCLXXXII.

At the bottom of the external paffage, which is lined by a fine membrane, we find wax, or a bitter fubftance like bile infpiffated, and which is feparated from minute glands. This membrane is femi tranfparent, looks like a bit of the pleura or peritonæum when wetted with water, and veffels are obfervable upon it. This membrane has no hole within it, but we find a large irregular fhaped cavity, about the fize of the laft joint of the finger. That cavity is compared to the cavity of a drum; and therefore the membrane which is found covering it, is compared to the parchment of a drum, or named membrana tympani.

CCLXXXIII.

There is no paffage then for air through the external meatus into the cavity of the tympanum, but there is a direct paffage into it leading from the throat. The tube is named tuba Euftachiana, and it is of the fhape of a trumpet, with the fmall end towards the ear, and, like the external meatus, the firft half is cartilaginous, and the other half, towards the ear, offeous. The part on which the impreffion of found is made, is at the bottom of the cavity of the tympanum; but a connection is made between this and the membrane of the drum by a very curious chain of bones, four in number, and termed the malleus,

incus, orbiculare, and ftapes. The fourth, or the ftapes, is connected to a membrane, with an oval hole at the bottom, fo named foramen ovale. Within that we find an enlargement of a cavity, and from that the ends of five, or rather fix, femicircular hollow tubes. The enlarged cavity, in which they terminate, is named veftible, and the canals begin and end in it. Two of thefe canals are joined, and hence there are only five openings.

CCLXXXIV.

There ftill remains one curious organ, like the fhell of a fnail, and therefore called cochlea, and this is turned round a gland. The bottom of the fhell, which is a hollow tube, communicates partly with the veftible ; but the outer half terminates at a round hole fhut with a membrane on the back of the cavity of the tympanum, and we find a partition dividing the cochlea the whole length.

CCLXXXV.

It is in thefe laft named parts, the cochlea femicircular canals and veftible, the portio mollis of the feventh pair of nerves terminates, fpread out upon the membrane which lines them ; and here, at laft, the impreffion of found is ultimately made, juft as the impreffion of light is made upon the retina of the eye.

CCLXXXVI.

The chain of bones which play upon one ano-
ther, is not merely formed by membranes, but
fmall mufcles are likewife conneꞔed to them.
An external mufcle has been mentioned as at the
bottom of the meatus; but this is hardly to be
found. But there are three others ; one of them
follows the courfe of the Euftachian tube, and is
conneꞔed to the malleus, which it draws a little
out and nearer to the middle of the head. It lies
parallel with a nerve, the branch at the root of
the lingual branch of the fifth pair, and it paffes
through the cavity of the tympanum like a
ftretched chord, fo called corda tympani; the
fibres of the mufcle are parallel, and a branch of
the portio dura can be traced into it.

CCLXXXVII.

From this general view of the feveral parts,
their ufe, and their manner of operating, fall
next to be confidered. Firft, we obferve, that
danger is guarded againft ; pointed inftruments
are hindered from entering the external cavities to
the membrane of the drum, partly by the protec-
tion which the prominence, named tragus, gives
to the paffage ; if we mean to ftop the external
paffage, we prefs our finger upon the prominence.
And the paffage is not altogether ftraight, but a
turn is made where the cartilaginous part joins with

the offeous.   This turn, however, is by no means
fo great, but that, by pulling backward the carti-
laginous part, we are able to fee to the bottom of
the paffage, and with the light of the fun to dif-
tinguifh the membrane of the drum.   Infects are
hindered from readily entering, by the number of
fmall hairs from the fides of it, and the very vifcid
wax, which is the chief or primary purpofe of the
cerumen, for it is not of any immediate confe-
quence to fit the ear for receiving the impreffion
of the found.

CCLXXXVIII.

In like manner, the internal paffage, the Eufta-
chian tube, is guarded.   There is little fear of our
food or drink being fqueezed into it in deglution,
for without fuppofing a contraction about its ori-
fice, fomewhat of a mufcular power inherent in
its membranes, the mouth of it is placed higher
than the velum pendulum palati, and it is accu-
rately fhut by the elevator palati, and by the fupe-
rior conftrictor of the pharynx.

CCLXXXIX.

Proceeding then to the particular parts of the
organ, we obferve of the external ones, that the car-
tilage under the fkin ferves to enlarge the tube in
which the tremor of the air is made.   Not that
we can demonftrate that the human ear is exactly
formed for collecting every tremor; for, in at-
tempting to affift the dullnefs of hearing, we find

other contrivances equally good, and we obferve
a great variety with refpect to the fhape in dif-
ferent animals, fome of which hear more acutely
than we do; but, by attending to the fhape and
winding of the paffage, it is obvious that the
found reverberates as it is thrown into the mea-
tus; and we have feen mufcles of the head con-
nected to the ear, which at leaft ferve to give a
tenfion to the part. Other animals affift their
hearing by thefe mufcles, pointing the bone of the
ear towards the fonorous body, whereas we are
under the neceffity of moving the whole head, fo
that the direct impreffion is made upon one ear
only, and there is no communication between the
ears, as in a bird, which receives the direct im-
preffion upon both ears at the fame time, a canal
leading from the one to the other. The fmall
mufcles upon the cartilages ferve alfo to give a
greater tenfion, and to throw off the found with
an additional force.

CCXC.

Within the meatus auditorius externus, the
found is collected and concentrated, and the wind-
ing paffage, inftead of leffening, increafes it, juft
as a found appears louder in a crooked paffage
made by walls, than if the paffage is altogether
ftraight. Perhaps, the found is thrown by the
fides of the paffage towards the middle of the con-
cavity to the very place where the bones are

connected to the membrane, for it is the chain of bones that pulls the membrane inwards. Through the chain of bones the found is communicated to the membrane of the oval hole or veftible ; i. e. to the three femicircular canals, and at leaft on one half of the cochlea; but the turns which the organ makes communicating, the whole cochlea and femicircular canals through the veftible are affected.

CCXCI.

Since the fmall bones have mufcles joined to them, it muft be admitted that they ferve to regulate the tenfion. And as in other animals the mufcles of the external ear are fpontaneoufly roufed into action, fo the internal ones are influenced likewife in the fame manner. Nor this may be carried farther ; for they net only act when the found is very low, and the tremor is not diftinctly communicated, but alfo a tenfion of the chord is made with the found, being thus more readily communicated to the chain of bones and to the membrane of the oval hole.

CCXCII.

Befides this, a general vibration is communicated alfo to the air within the cavity of the tympanum, and which is conveyed there by the Euftachian tube ; for, unlefs the tremor had affected the air in general within the cavity of the tympanum, that paffage might have been wanting. If it was only neceffary that the found

fhould be conveyed through the chain of bones, there was no neceffity for air within the bones; and there is no doubt, that were the fmall bones taken out, without a læfion of the parts, ftill we fhould be able to diftinguifh the variety of found.

CCXCIII.

On confidering the irregular fhape of the cavity, and the communication it has with the cells of the maftoid procefs, it might be fuppofed that the ىrm r of collecting the found was con- its being diffufed in a cavity of fuch the fides of it are made of hard bone, ften for the , and the outlet is fmall. thus a ftriking analogy is afforded between this part of the ear and the common inftrument, the memb. here refembling the parchment of the drum, the cavity within, and the Euftachian tube, the cavity and holes in the fide. As the finufes, communicating with the nofe, increafe the voice, and render it more melodious, fo the fame thing may be applied to the ear; and, if a tremor is communicated by the cavity, the found in that manner is increafed, and applied through the ear to the bottom of it. And this is a fecond manner in which we receive the impreffion; and one half of our cochlea terminates at the membrane fhutting the foranien rotundum, and has no immediate connection with the chain of bones.

h 5

CCXCIV.

A third manner of communication has been
fuppofed, that the tremor is communicated to the
parts within, directly through the Euftachian tube,
ferving the fame general purpofe with the external.

CCXCV.

Thus, there are two chief ways in which we
receive the impreffion of found : one through the
chain of bones, the other through the membrane
of the tympanum and the air in the cavity. There
is another way, that has no inconfiderable effect,
the general tremor of the bones of the head and
of the whole body. So perfons in whom the
external ear is corroded, and the chain of bones
perhaps deftroyed, diftinguifh very loud founds in
this way ; and if you apply any tremulous fubftance
to the jaw bones, as ftriking the grains of a fork,
you hear as it were a very loud found. The com-
mon account here is, that the nerves are connected,
fo the tremor paffes from one nerve to another ;
but ftill the found is much more diftinct when the
tremor is communicated to the teeth of the upper
jaw, though they are the nerves of the under one
that are chiefly connected, a branch of the fifth
pair being connected to the feventh ; and that
obfervation may be applied to practice, with con-
fiderable relief. Thus, if we want to converfe
with a perfon dull of hearing, a thin piece of very
hard wood may be taken that can have a tremor

eafily communicated to it, one end is applied to
his fore teeth of the upper jaw, and the other end
of it is put into your mouth, and by fpeaking, he
will apprehend what you are faying, though he
is not able to hear a fingle letter, if the bit of
wood be removed; fo it is communicated through
the bones which imprefs the nerves of the ear, as
they receive the impreffion from the tremor ap-
plied in the other two ways.

CCXCVI.

By receiving an impreffion in different ways,
perhaps we judge better of a found than if the
tremor is communicated in one way only.

CCXCVII.

The ufe of the Euftachian tube feems confined
to one purpofe chiefly, to fupply the cavity of the
tympanum with elaftic air, properly warmed be-
fore it reaches the very tender parts of the in-
ternal air. Another purpofe of it is perhaps to
convey moifture, or fordes, collected by the fecre-
tion within the cavity of the tympanum; and this
may be more neceffary here where the air is ad-
mitted; for, as the fubftances floating in the at-
mofphere are conveyed into it, thefe fhould again
have a proper outlet.

CCXCVIII.

It remains to determine the way in which the
impreffion is conveyed from the membrane of the

oval and round holes to the portio mollis of the auditory nerves; for, after bringing the nerves to receive the tremor, we can give no further account why we judge so accurately of sound, any more than we can explain the effect that the objects of sight have upon the retina; and the question that occurs here is this? Whether are we to say that the tremor is communicated through air filling the cavities of the vestible and semicircular canals, or are these replete with water? Upon the whole, it would appear that the tremor is communicated to water, and through the water to the nerves.

CCXCIX.

In regard to the great size of the semicircular canals and cochlea, they are proportionally larger in a child than the corresponding bones; the reason of which is, that a very considerable hard-ness of bone, capable of tremor, is here necessary; and these hard bones do not grow in the same porportion with the rest of the body: as with re-gard to the teeth, nature does not so readily in-crease the hard parts so quickly as the soft, and there being no room for making a change here, as in the teeth, these parts are cast in a larger mould.

CCC.

In examining the circulation of the ear, we find that the arteries of the external ear come ante-riorly from the temporal, and posteriorly from the

occipital, both being branches derived from the
external carotid; and its veins pafs partly into the
external, and partly into the internal jugulars.
The origin of the pofterior auris is from the fitua-
tion of the parotid. It paffes under the ftyloid
procefs, and goes up directly behind the ear; and
after giving branches in its progrefs, it diftributes
one twig, termed arteria tympani, to the loweft
part of the cartilage, which fpreads itfelf on the
drum of the ear, and in the child it is particularly
large. Its next branch, of confiderable fize, enters
the maftoid hole as the great nerve of the face
comes out, and this artery divides upon the tym-
panum by a branch furrounding the bony circle,
and then fpreading over the membrane, another
twig fupplies the mufcle of the ftapes and the
femicircular canals. Branches alfo play round the
back part of the concha, or fhell of the ear.

CCCI.

The nerves of the ear are numerous from
various fources. The forepart of the ear is fup-
plied with nerves from the 3d branch of the 5th
and the portio dura of the 7th pair: the under
and back part, by branches from the 1ft and 2d
cervicals. But the chief nerve of the ear is the
auditory one. It is compofed of two branches,
one of which is called the portio dura, and the
other the portio mollis. The trunk of this nerve
paffes into the external meatus, covered by the

invefting membrane of the brain. The portio dura diftributes its branches on the ftapedius mufcle and maftoid cells. The portio mollis divides into two parts, one fupplying the cochlea, the other the veftible. Thus the portio mollis forms the primary part of the organ of hearing, to which all the others are fubfervient, and is the fame expanfion to the ear that the retina is to the eye.

CCCII.
Chemical Analyfis of the Secretion of the Ear.

The fecretion of the ear is in fmall quantity in health, and it affumes at times a folid cylindrical form from the attraction of oxygen from the atmofphere. It is of a yellowifh colour, of an unctuous or waxy confiftence, and bitter to the tafte, without becoming rancid while retained in the ear.

Its conftituent principles appear to be ;

1. Animal mucus.
2. A ceraceous part, or oil, infpiffated by oxygen.
3. A bilious principle fecreted from the blood.

The Euftachian tube fecretes a mucus which paffes into the fauces, but differs in nothing from mucus elfewhere, confifting merely of infpiffated lymph.

The cavity of the tympanum is filled with an infipid water, which has no tafte or fmell, but becomes white, and is infpiffated by the fulphuric acid.

CCCIII.

Defcending from the parts laft demonftrated, we come to examine the throat. It confifts of three divifions, the arches of the palate, the pha-

rynx, and larynx, and each of them were already
partially confidered, from their connection with
the mufcles.

CCCIV.
Arches of the Palate.

The arches of the palate are formed by a doub-
ling of the fkin, joined by fome mufcular fibres
arifing anteriorly from the middle of the velum,
and fixed to the fide of the edge of the tongue;
and pofteriorly from the fame origin, but paffing
down by the fide of the pharynx.

CCCV.

The anterior arch compofes, with the mufcles
defcribed (Vol. I. CCCXXVI.), the ifthmus fau-
cium. The pofterior inclofes the levator mufcle;
and between the two arches, clofe by the bone of
the tongue, is fituated the amygdalæ, of an almond
figure, reddifh colour, full of communicating cells,
and with large irregular openings for the difcharge
of mucus into the throat, the quantity of which
is promoted by the action of the adjacent parts.

CCCVI.
Pharynx.

The pharynx was difcuffed in (Vol. I. CCCXXVII.)
Its circulation is conducted by the pharyngeal
branches, which come directly or indirectly from
the external carotids, and its blood is returned to
both the jugular veins. Its nerves are derived
from the 8*th* pair.

CCCVII.
Larynx.

The larynx, the laſt diviſion, was alſo demon-
ſtrated at length, (Vol. I. CCXCIX.) with its
ſeveral appendages. The circulation of this part
depends alſo on the external carotids in part, for
they give off to it the two ſuperior laryngeals : but
it has another, likewiſe, from the ſubclavian
artery, or the two inferior laryngeals ; and its
blood is all returned to the external jugulars. Its
nerves are prolongations of the *8th* pair.

CCCVIII.
Trachea.

The continuation of the larynx, or the trachea,
forms the paſſage to the lungs. It is of a ſomewhat
conical figure, at firſt cylindrical, capable of ad-
mitting a finger in ſize, and narrower at its under
end. It paſſes into the thorax behind the ſternum,
between the pleura ; and, at the fourth vertebra
of the back, or curvature of the aorta, it divides
into two branches, termed bronchia, one to the
right and another to the left, which enters the
lungs, the right ſide being ſhorter than the left,
in oppoſition to what takes place in reſpect to the
pulmonary arteries.

CCCIX.
Bronchi.

The bronchi are ſpread on the lungs, and mi-
nutely dividing, at laſt terminate in the cells which

have a free communication with each other, fo that the introduction of air into the bronchial branches inflates a portion of the lungs.

CCCX.

The trachea is formed, for the purpofes of firmnefs and ftrength, of from 16 to 18 cartilaginous rings; and by this ftructure it is preferved conftantly pervious for the tranfmiffion of air. Behind thefe rings are incomplete, and the trachea is even flefhy, in order to yield to the action of the æfophagus in the time of deglutition. Thefe cartilages are placed horizontally to each other; they form a large fegment of a circle, and they are united to each other by a firm ligamentous fubftance; though, in their upper part, little or no fpace intervenes between them.

CCCXI.

The divifion of the bronchi is diftinguifhed at firft by the fame ftructure, but, as they enter the lungs, the circle of the cartilage is broken into pieces, and only fo much is preferved of it as to keep the paffage open and free.

CCCXII.

This ftructure of the trachea is defended by feveral coverings, both to ftrengthen and give it motion. The firft of thefe is a cellular matter, covered on its entering the thorax by the mediaftinum. The fecond is an elaftic ligament, paffing

along it, and adding to the elaſticity and firmneſs of its branches. The third is a muſcular coat, chiefly conſpicuous between the rings and at the back of the trachea, and poſſeſſing, externally, circular fibres for ſtraitening the paſſage, and internally, longitudinal ones for ſhortening it. Theſe longitudinal fibres are the moſt extenſive, and paſs far into its branches in the lungs.

CCCXIII.

The internal furface of the trachea is lined with a vaſcular irritable membrane, every where poſſeſſing a mucous and lymphatic ſecretion. The exiſtence, therefore, of mucous glands and exhalant veſſels, is every where to be traced on this ſurface. But, beſides this, for the ſame purpoſe of defence from irritation, ſome farther glandular appendages are connected with this part. Theſe are the thyroid gland, the tracheal glands, and the bronchial.

CCCXIV.

Thyroid Gland.

The thyroid gland, ſo termed from the cartilage formerly deſcribed, is a large reddiſh maſs behind the ſterno-hyoid and ſterno-thyroid muſcles, at the under and fore part of the larynx. It deſcends a certain way upon the trachea and œſophagus, and it poſſeſſes two lobes joined by an intermediate portion. From the viſcid liquor it ſeems to ſecrete, and its internal granulous

appearance, its office we would infer to be, to lubricate the adjacent parts. For this purpose it is supplied with large blood veffels and nerves from thofe of the larynx, but ftill no excretory duct has been difcovered in it to render its ufe certain.

CCCXV.
Tracheal Glands.

The tracheal are a numerous fet of mucous glands, fituated in the mufcular coat of this membrane, and extending alfo into the lungs. Their office is evident, from each poffeffing an excretory duct that throws out a mucus on the furface of the membrane.

CCCXVI.
Bronchial Glands.

The bronchial glands occupy the cellular fubftance at the under part of the trachea and roots of the bronchi. They are of various fizes, of a bluifh or dark colour, refembling fome parts of the lungs, and they are evidently, when examined, of a lymphatic nature.

CCCXVII.

The circulation of the trachea is fupplied by the inferior laryngeals, and its nerves are portions of the recurrent and great fympathetic pair. The lungs poffefs, as it were, a double circulation, the one by the pulmonary veffels, and the other by the bronchial.

CCCXVIII.

The ufe of the pulmonary circulation was already explained in confidering that of the heart. This circulation is carried on by the pulmonary artery dividing into two branches of right and left, which are difperfed through the fubftance of the lungs, and form by their minute branches plexus, giving out the halitus expelled by the organ in expiration. The pulmonary veins join in four principal trunks, which collect the blood, and return it to the left auricle of the heart; and the veins through the whole fubftance of the organ bear an inferior proportion to the fize of the arteries.

CCCXIX.

The bronchial circulation again, or that peculiar to the lungs, is conducted by means of three or four fmall branches, which, except one arifing from the right fuperior intercoftal, are all from the aorta. They are minutely difperfed on the bronchi, in the glands and lungs, and they are found to communicate with the pulmonary artery, fo that the nourifhment of the organ cannot be their fole ufe. Their blood they return to the vena azygos and left fuperior intercoftal vein.

CCCXX.

The nerves of the lungs are fmall in proportion to the fize of the organ. They are chiefly derived

from the 8*th* pair, and alfo in part from the great fympathetic.

CCCXXI.

From this view, a large apparatus is provided for the fecretion of lymph and mucus to lubricate and moiften the furface of the paffages to this organ. Hence it would appear neceffary that this large fupply fhould be afforded to guard againft the action of the gazeous fluids, which are conftantly extricated by expiration, and which thus unfolded, might act two powerfully on the paffages through which they are expelled, producing inflammation and other confequences.

CCCXXII.

In a former part, we confidered in a general way the ftructure of the lungs, but it is only when fully examining that of the trachea, or the paffage into them, that their minute parts come properly into review; the principal and moft important of thefe minute parts, as the ground work of their ftructure, is the air veffels. The trachea is compofed of membranes, with mufcular fibres and rings of cartilage, which are imperfect behind. This allows the food to defcend in the æfophagus; and the circle not being complete, the trachea in the refpiration and formation of the voice, alters its length and diftenfion more readily.

CCCXXIII.

When we follow the trachea to its divifion

into branches, a fimilar ftructure takes place a great way through the fubftance of the lungs; but as now there is no reafon why the defect fhould be only in the pofterior part, the fegment makes perfect portions of a circle in the whole circumference, till the tubes become membranous; and thefe terminate in cells of a fimilar ftructure, fo far as we may judge by the eye.

CCCXXIV.

Thefe ultimate branches of the trachea can be feen with the naked eye. The minute cells are found to communicate freely with one another, fo that if we blow air into the fmall branches, a much greater portion of the lungs is inflated, and from a fingle lobule we can fill the whole lobe; fo every cell of the lungs has not its correfponding branch, but they are more numerous, and the cells are fo extremely minute, that upon entering into a calculation we are furprifed with the vaft extent of furface; and the pulmonary artery has a very minute divifion, every where giving redrefs to the fides of the cells.

CCCXXV.

The air within the cells is confined by a membrane proper to the lungs, and this membrane is more extenfive than merely from viewing the lungs we would conceive; for the divifion into les goes to a great depth, and thefe divifions

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of the lungs into lobules, allow them to accom-
modate themselves to the size of the thorax, every
part to be expanded in the most equable manner.
That their play upon each other may be the easier,
and they may the more readily retract, a cellular
membrane enters between the lobules; and the
whole is covered over with the pleura, without
any communication. It has been supposed that
the cells communicate with the common cellular
membrane, the consequence of which must be the
diffusion of the air in the interlobular cellular
membrane, and from that over the whole body;
hence we should be exposed to emphysema and to
anasarca in the lungs, the water making its way
into their cavity. When the lungs are taken out
sound, we can indeed, upon blowing in air,
make it go into the interlobular cellular mem-
brane, and we are apt to imagine that when we
do this with the force of our breath, the same vio-
lence is done to our own lungs; but our lungs are
prevented from over distension by the containing
parts of the thorax, so that we can burst lungs
that in life were stronger than our own; and
before opening the thorax, we are often not
able to make injections pass into the cellular
membrane. Thus we may compare this membrane
proper to the lungs, to the pia mater of the brain,
whilst the pleura is represented by the tunica
arachnoides. It chiefly allows the lungs to play

upon the ribs without being injured, fo the ribs are lined with the continuation of the fame membrane.

CCCXXVI.

Practical authors treat the cells of the lungs as poffeffed of a truly contractile power, and they fuppofe that the appearance of fuffocation depends upon the contraction of the cells of the lungs. That the veffels entering into the compofition of the lungs may be fpafmodically affected, is to be admitted; but there is no reafon to fuppofe that the cellular texture is truly mufcular in its appearance; and in different animals, when the lungs are irritated with a very acrid liquor, no immediately fubfequent contractions enfue; and in the afthma the fuffocation depends very much upon the affection of the glottis, the various affections of which are more frequently afcribed to the lungs than they ought; alfo whilft we admit the affection of the veffels of the lungs, we muft regard the change produced on the glottis, which can be conftricted on the moft accurate manner.

CCCXXVII.

With regard to the circulation of the blood in the lungs, the fame quantity of blood paffes through the lungs in the fame time as through the reft of the body; and the quantity and velocity are nearly the fame in the pulmonary artery as in the aorta. The force, however, is very dif-

ſcient from the difference of thickneſs in the two ventricles. In the aorta, the force is three times greater than in the pulmonary artery; but when we conſider the diviſions made by the pulmonary artery in the lungs, they are by no means ſo extenſive as the diviſions made by the aorta, and, therefore, though the force of the blood is greater in the trunk of the aorta than in the trunk of the pulmonary artery, the force in the extreme branches of the pulmonary artery is greater than the force in the extreme branches of the aorta; and on that circumſtance depends an obſervation, that a wound in the lungs bleeds more violently than a wound of moſt of the bowels belonging to the aortic ſyſtem. Comparing the force of the two ventricles, the thickneſs of the left ventricle is three times that of the right; but the number of veſſels of the aorta is fifteen times greater, for the lungs do not make above the thirtieth part of the weight of the body. Now, making an allowance for the earth of the bones, the fat and extravaſated liquors, and allowing that the lungs are more purely vaſcular, the blood is ſtill ſpent upon a field that weighs fifteen times as much; and, where the veſſels are numerous in proportion to the weight, the number in equal portions is greater; for, upon injecting fluids, they paſs more readily from the pulmonary artery into the vein than in other places of the body.

CCCXXVIII.

It is generally fuppoſed that the veins are not in ſuch proportion to the arteries in the lungs as elſewhere, but there is no ſuch difference as is generally fuppoſed. In the aortic ſyſtem many veins run under the muſcles, and hence there are two ſets, and the cava is larger in proportion than the pulmonary veins. There is, likewife, an inequality in the ſize of the two ſides of the heart; the right one is originally larger than the left, and, perhaps, the difference increaſes with uſe or years, becauſe of the unequal ſtop in reſpiration, the blood paſſing with more difficulty through the lungs in the ſtate of expiration than in inſpiration when the veſſels are drawn more out into ſtraight lines, and the preſſure of the air within the lungs is taken off, for the air does not not ſo readily enter by the narrow paſſage of the glottis as to make the ſame preſſure in inſpiration as takes place in expiration. When the ſides of the thorax are drawn in, from the paſſage of the air being difficult through the glottis, the pulmonary veſſels come to be compreſſed.

CCCXXIX.

There is a minute diviſion of the blood veſſels upon the cells of the lungs, which appear every where red upon the veſſels being injected, but there is no appearance except of glands, for mucus, and yet a ſeparation is made from the

extremities of the pulmonary veffels of a matter
that is pernicious to animals, as already explained.

CCCXXX.

Befides the pulmonary veffels, there are other
fmall but conftant arteries derived from the aorta,
the bronchial ones, the number varying in different
fubjects, and they make a very intimate divifion
through the fubftance of the lungs. At firft we
might imagine that they are accidental *lufus naturæ*,
from the aorta fcattering itfelf on all fides, but we
cannot doubt that material purpofes are ferved by
thefe veffels, though it is difficult to fay what
thefe may be. In like manner, the coronary arte-
ries of the heart are derived from the aorta only;
and, tracing thefe back, the veins terminate on the
right fide, though we fhou'd have imagined that
they would have more readily gone into the left
auricle with the pulmonary ones: and, in the liver,
though we find a great quantity of blood furnifhed
by veins, and forming the vena porta, we fhall
find a branch conftantly from the aorta: fo that it
would appear that there are purpofes neceffary to
be done in the various organs, which the whole
mafs of blood, or veffels carrying it through thefe
organs, are not fitted to execute, or that a greater
change is produced by a *fingle* circulation than at
firft fight we are aware of.

CCCXXXI.

It is generally fuppofed that the bronchial vef-
fels ferve for the nourifhment of the lungs; but,
though the nutrition depends upon the blood vef-
fels, it cannot be with certainty affirmed that this
is the purpofe they ferve, nor ftill lefs that it is
the fole purpofe. It can only be faid that, by a
fingle circulation a confiderable change is made;
and that, by a paffage of the blood through the
lungs, a fomething wanting is reftored to it, and
yet we fhall find that all that is received by the
abforbent veffels of the lungs, paffes into the right
fide of the heart, and is furnifhed to the pulmo-
nary artery.

CCCXXXII.

Following the bronchi l arteries with care, they
communicate with the pulmonary ones, and thefe
anaftomofes are fometimes found of confiderable
fize.

CCCXXXIII.

A number of minute glands are obferved on the
back of the trachea, that make circles in the rings
of the trachea, and which evidently pour out
mucus. Thefe glands can be traced in the larger
branches of the trachea, and what is feen there
may be applied to the moft minute branches, as
they muft have a very extenfive diftribution here
as in other places, wherever the air has accefs,
or acrid liquors are applied, which require the
feparation of a mucous or febaceous matter.

CCCXXXIV.

There is another set of glands, the use of which it may be more difficult to determine, the glands named bronchial. Some authors are disposed to arrange these with the lymphatic glands; but, when speaking of the secretions in the trachea arteria, they are mentioned as performing a secretion. At first sight, there is a degree of improbability in the opinion, and they were led into it from this circumstance, that these glands from the division of the trachea are of a dark colour, and we throw out from the trachea dark blue coloured matter after twenty years of age, hence it is inferred that there must be a communication between the bronchial glands and the cavity of the trachea. But the whole matter is to be explained very differently: all the matter absorbed from the lungs passes to the right side of the heart; so the changes made upon the blood in this lesser circulation, do not depend upon a difference of mixture or parts.

CCCXXXV.

With regard to the colour of the matter in the bronchial glands, in a young subject nothing is observed of the black matter. In an adult, the colour of the lungs gradually changes from a brown to a black colour, and the same vessels which, by separating a certain substance, give

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that black colour to the folid part of the lungs, by making a fimilar fecretion into the cavity of the trachea, may give the fame colour to the mucus. Thus the extremities of the pulmonary artery difcharge, by the exhalant terminationes, the black colour, and the bronchial glands giving paffage to the abforbent veffels, receive the black tinge from the lungs. The trachea receives the colour fiuft, and communicates it to the bronchial glands; and, as all the folid parts of our body are conftantly undergoing a change, the folid mafs of the lungs themfelves will be in courfe gradually re-illumed by thefe abforbent veffels, fo the colour will alfo be communicated in that way, and the colour of the lungs of thefe glands always correfpond. From this, the bronchial glands ferve a fingle purpofe, that of abforption, and receive their colour from the lungs.

CCCXXXVI.

Having fully traced the circulation of the carotid, or firft fuperior aortic branch, through the different organs it pervades, we next purfue the courfe of the fecond, or the fubclavian. It confifts of two branches, the left fubclavian, and the right one. The former emerges from the aorta at its turn towards the fpine, paffing out of the cheft obliquely, and receiving its circulation in an unfavorable direction. The right fubclavian takes its origin from a common branch between it and

the carotid, rifing on the top of the aortic arch, and receiving the blood in a direct current.

CCCXXXVII.

As the fubclavians pafs along in their progrefs, their name becomes changed. Within the breaft they preferve their appellation, in the arm pit they are termed axillary, down the arm brachial, when dividing at the bend of the elbow, radial and ulnar, and in the head they are loft in a variety of vafcular divifions.

CCCXXXVIII.

In its firft divifion, or real fubclavian courfe, it is protected by the bone of that name. It is here of great fize, and runs directly acrofs at the root of the neck, and it fends off a variety of branches both upwards and downwards.

CCCXXXIX.

The firft of its branches paffing downwards is the internal mammary; and, as this artery fupplies the circulation of the breaft, the ftructure of that organ becomes properly premifed; and being an organ of more importance in the female than in the male, the female breaft is preferred for examination.

CCCXL.

Breafts.

The female breafts are two glandular bodies, fituated on the anterior part of the thorax fome-

what laterally, and loosely adhering to the pectoral muscle: a situation which only distinguishes the human female and the ape, for in quadrupeds they are placed under the abdomen.

CCCXLI.

Though two are almost universally the number appropriated to women, in some rare instances a variety has been met with, as two on one of the sides, and even two on both sides.

CCCXLII.

The size of the breasts is very different in different females, and in no organ of the body is a difference of size so conspicuous. Previous to puberty they are always small; but they evolve, and become prominent as the menses take place. Their size is gradually increased by gestation, and comes to its ultimate magnitude after delivery. As child bearing departs from the age of 45 to 50, when the menses disappear, their size diminishes; and they gradually, in the advance of life, turn wrinkled and flaccid.

CCCXLIII.

The chief magnitude of the breast, in its ordinary state, is formed by a quantity of fat, which defends the glandular parts but does not, as it is alleged, pass into or communicate with the lactiferous tubes, or has a connection with the formation of the milk.

CCCXLIV.

The glandular, or secretive part of the breast, is of the conglomerate kind, of a whitish firm texture, and irregular in its substance. It is composed of a number of small follicular masses severed by fat, and these undergo most minute changes.

CCCXLV.

Nipple, or Papilla.

In the centre of the breast is the nipple or papilla, ... in its colour, and cylindrical in its form, of various sizes in different females, and increased by the same circumstances which increase the size of the breast, being particularly liable to be distended by titillation and passions of mind. It is formed of tough ligamentous substance, or a condensed cellular structure, which incloses the lactiferous tubes, is easily drawn out or distended, and from its elasticity collapses readily again when the distending cause is removed. Upon its point, or apex, are placed the lactiferous orifices, which correspond in number to that of the tubes, being from 14 to 20.

CCCXLVI.

Around the nipple is a conspicuous circle or disk, named the areola, varying in colour from the rest of the skin, and deriving this appearance from a number of sebaceous glands which pour out a quantity of sebaceous matter to prevent the

skin from being excoriated. The colour of this disk varies at different periods of life, and under various circumstances. Thus it is florid in girls, pale brown in women more advanced, and it becomes livid and dull with age. Thus, also, it becomes darker in pregnancy than at any other time.

CCCXLVII.

The circulation, then, of this organ is supplied by the mammary arteries, external and internal. The former are sent off from the subclavian, as already noticed, the latter from the same artery in its further progress, when it receives the appellation of axillary, and the different divisions of these arteries enter the breast at different places. These are also accompanied by corresponding veins which receive the same name.

CCCXLVIII.

From the extremities of the arterial circulation of the breast, arise the lactiferous tubes, which are extremely numerous, and gradually unite into trunks, running in a radiated manner round the circle of the nipple. They form the reservoir of the milk, and are accordingly considerably increased in size in the time of suckling.

CCCXLIX.

At the root of the nipple the number of lactiferous tubes becomes contracted from 14 to 20, their number varies much in different subjects,

and they have therefore been varioufly reprefented by different authors.

CCCL.

They have been alfo fuppofed to poffefs a circle of communication, but this is difproved by the courfe of injections. The fituation of the tubes in the nipple is peculiar for the purpofe of preventing a fpontaneous flow of the milk.

CCCLI.

This peculiarity confifts in their diftance from each other, and in the coiled up form in which they are placed. Thus, when drawn out and extended, they become ftraight, but eafily recover their former fituation on the extenfion being removed, or they become narrower and crooked.

CCCLII.

Though the fecretion of the breafts is the effect of conception, yet a fluid is frequently formed in them in other fituations. Thus, at birth, the cutaneous tubercle of the infant's breaft contains often a milky liquor, and continued fucking has often brought to the breafts of girls and old women an appearance of milk, nor has this fluid been wanting in men on the application of the fame means.

CCCLIII.

Sucking is an operation which, in fome refpects, refembles the principles of the air pump..

But the child does not merely apply the lips round
the nipple, and then make a void in the mouth,
but it assists the elongation of the nipple, and
stimulates it so as to cause the filling of the cells,
or the child takes hold of it with the tongue, and
drags it mechanically into the mouth, using the
tongue like the sucker of a syringe, and the
membrane of the lips of the child is swelled and
raised for excluding the air, which has been mis-
taken for a diseased state of these parts, and the
tongue being drawn back for making a void, the
pressure of the air upon the breast pushes the milk
where there is the least resistance. But, by an in-
stinct of nature, the child adds somewhat, for it
applies the hand to the nurse's breast, and even,
at the same time, uses the feet to press against the
side, that they may act with greater force.

CCCLIV.

Chemical Analysis of the Secretion of the Breasts.

The secretion of the breasts, or milk, is a fluid, white,
opaque, inodorous, and sweet. It is of an oily and
aqueous consistence, a drop falling on the nail should
flow slowly down.

This secretion begins in the last months of preg-
nancy, and appears on the second or third day after
delivery by a fullness and distension of the organ. It
is first separated of a somewhat serous nature, termed
the colustrum, but soon acquires its proper quality.

This secretion continues so long as the child con-

tinues to fuck, even for years, and is only interrupted by a fresh pregnancy.

The quantity secreted in a given time, is various in different women, and depends much on the quantity of nourishment and other circumstances, but not more than 2 lbs of milk have been considered as arising from 5 or 6 lbs. of meat.

This secretion is found naturally to separate into three parts, an oily, coagulable, and watery part, and this separation takes place sooner in an increased tempe-rature than otherwise; and it is also promoted by salts and particular coagulable plants.

The constituent principles of the milk are;

1. An aroma, or odorous principle, which flies off when fresh drawn.

2. Water, which constitutes its greater part; for, from 1 lb. 11 oz. of water are procured.

3. Oil, or cream, which swims on its surface after standing.

4. Cheese, or coagulum, which separates from the other parts, and falls to the bottom.

5. Sugar, procured by evaporation of the serum.

6. Various neutral salts, as tartrite of potash, phosphate of lime, &c.

These constituent principles, thus united, we next examine, as they exist in its particular parts.

Thus, its cream, which resembles the vegetable fixed oils, consists of carbon, hydrogen, and sebacic acid.

Its cheese, or coagulum, which is of the same nature as the animal gluten, is formed of carbon, azote, and phosphate of lime.

Its ferum is a compofition of its water, aroma, and fugar, with the neutral falts formerly noticed. Hence this part forms the medium, uniting by means of its fugar the cheefy and oily part with the purely aqueous.

The fugar itfelf is the bafis of the faccho lactic acid, and forms alfo the acid of fugar; both which are procurable by a particular treatment.

The milk, like the other fecretions, is much varied in its nature from a variety of circumftances; as,

1. From particular food. Thus a vegeto animal diet unites its parts more completely than any other, and it is not fo liable to alcency as from vegetable diet alone.

2. From time of digeftion. For the milk is beft at a due period, or 4 or 5 hours after eating, when digeftion is completed.

3. From period after delivery. For it is at firft too ferous, and gradually acquires more of the coagulable principle as the period of fuckling advances. Hence old milk is improper for a young child.

4. From peculiar fubftances or medcines. Thus milk becomes impregnated with the odor of garlic, and medicines given to the nurfe, by their change on the milk affect the child.

5. From paffions of mind. Thus affections of the nervous fyftem produce often fuch an alteration in the fecretion, as moft fenfibly to affect the health of the child.

Anatomical Preparation of the Breaft.

To prepare the breaft requires much time and patience. A milk breaft fhould be preferred; and the

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first step is to remove it carefully from the body with-
out wounding any of its parts. The nipple being
next examined, a bristle is to be inserted into each of
the excretory ducts, and into one of them the pipe is
to be afterwards introduced, so as to distend them with
quickfilver. When completely filled, the orifice is to
be secured by replacing the bristle, and in this way
each tube is to be filled by withdrawing the bristle;
and after injecting it again, replacing it. When
finished, the orifices of all the ducts are to be secured
by a ligature, embracing the whole nipple when the
bristles are entirely withdrawn. If any tube has given
way, or been wounded, it must be next secured, and
then all the fat and other extraneous substance is to be
carefully dissected away; after which, the part is to be
macerated to free it as much as possible from blood;
guarding against putrefaction; after which, it is to be
exposed to a current of air to dry as soon as possible.
When dried, it is next to be preserved in fine oil of
turpentine, which will render it transparent, and dif-
play the distribution of the lactiferous tubes.

CCCLV.

The internal mammary artery sent off, as for-
merly noticed, from the subclavian, is about the
size of a crow quill. On each side of the chest
it passes down along the inner surface of the ster-
num, and terminates at the ensiform cartilage by
numerous inosculations with the epigastric artery;
and this connection of the two arteries is intended
merely to guard against obstructions. Yet more

material confequences have been fuppofed to at-
tend this communication, for it has been fuppofed
that the flow of milk, after delivery, depends
upon it. Immediately after delivery there is a
great difcharge from the uterus; and in confe-
quence of the mouths of its veffels being fo freely
opened, the pufh is leffened into all the other
veffels, fo it is feveral days before the milk ap-
pears. But as foon as, by the contraction of the
uterus and the blood coagulating in the mouths
of the veffels, a fmall quantity is circulated through
the body of the uterus, there is an increafe of
the momentum of the blood in the epigaftric ar-
tery to the mammary one, which is fuppofed to
occafion the flow of milk.

CCCLVI.

But this is abfolutely inconfiftent with anato-
mical facts, and the theory cannot be recon-
ciled with the general laws of the circulation of
the blood; for if the flow of the milk depended
upon the particular courfe of the epigaftric artery,
and the force of the circulation was increafed in
this, inftead of finding that it only communicates
by fmall branches with the internal mammary
artery, we fhould have found it to terminate im-
mediately upon the mamma: it is inconfiftent
with the laws of the circulation to fuppofe it.
For are we to imagine that the blood runs from
the fmalleft branches of the artery into its trunk?

This never happens, unlefs when the mammary
artery is taken up with a ligature.   And this is
one ufe of the joining, that in cafe of an obftruc-
tion of the mammary artery, there may be a
fupply.   But, in the ordinary courfe of the circu-
lation, it is abfurd to fuppofe that any blood
enters the breaft this way.   The only effect is,
admitting that lefs paffes through the uterus, and
that more enters the epigaftric artery, the blood
will not pafs downwards by the fmall branches of
the mammary artery, as before.   But it is to be
doubted, if the communication can have fuch an
effect, for, before delivery, the uterus preffing
ftrongly upon the defcending aorta, and upon the
containing parts of the abdomen, would make a
greater refiftance to the defcent of the blood by
the branches of the mammary artery than the in-
creafed momentum of the blood in the epigaftric
can do, fo that the force of the circulation in the
internal mammary artery is the fame before de-
livery as after.   This matter may be even brought
to the decifion of an experiment ; for, if we were
to cut through the rectus mufcle, and divide all
the communicating branches, we would ftill find
the flow to the breaft take place in the ufual
manner.

CCCLVII.

We muft have recourfe, therefore, to an ex-
planation that depends upon very different prin-

ciples. Whatever idea we entertain of the cause of the menstrual flux, whether it depends upon a general or partial plethora, at delivery the constitution has been in the habit of preparing blood both for the mother and child; and that habit continues to remain for a certain length of time. For the first days, indeed, after delivery, there is a general debility from the openness of the vessels of the uterus, and the great discharge of blood; but when it is stopped by the blood coagulating in their orifices, and by the uterus greatly contracted, as the vessels of the body have accommodated themselves to the quantity of liquors they contain, and as every woman with child has the vessels immediately distended, there is still remaining a considerable degree of fulness; so that unless some outlet is given by the breast, by sucking, nature seeks an outlet some other way; the woman sweats very profusely, or is in danger of falling into some disease, as a fever. Hence there is the necessity of the separation of the milk.

CCCLVIII.

Besides, nature nourishes the child, before delivery and after it, nearly in the same manner, and by liquors nearly of the same nature; but there is a secretion in the uterus resembling that made in the breast. And wherever the nourishing vessels are collected into glandular masses, as in cows and sheep, we find in these a liquor in

colour and taste resembling the milk. In the
human body the vessels are not so collected; but
by their division upon the ovum a similar secre-
tion is made.` And when that secretion comes to
be interrupted, and the vessels recover their tone,
then the flow is towards the breasts, just as when
the perspiration is stopped there is a flow towards
the kidneys, the organ that resembles that the
nearest. And if the child is applied, by the
sucking the flow is better determined, and that
independent of other causes: this in animals that
formerly had young will even bring again the
milk. We conclude, therefore, that as the vessels
of the mother had been in the habit of preparing
more nourishment than was necessary for herself
during the nine months of pregnancy, that this
constitution for a certain time remains; and as the
secretion made in the uterus resembles that made
in the mammæ, when there is an interruption of
the one secretion, there is an increased secretion
in the other glandular organ.

CCCLIX.

While the internal mammary artery inosculates,
as we have seen, with the epigastric, the external
one does the same with the lumbar arteries. In
its progress, as it passes down along the chest, it
gives off several branches. One of the chief of
these is the upper artery of the diaphragm, and
its lower artery is the first branch of the aorta
within the abdomen. The mammary branch ac-

companies the phrenic nerve in its courfe, and is fpread out along with it on the diaphragm. In its progrefs it diftributes fmall twigs to almoft all the parts within the chef. Befides this, the mammary artery gives two branches to the pericardium, the one the upper, and the other the phrenico pericardiac artery. It diftributes likewife many fmall branches to the mediaftinum, and fends others to the interftices of the ribs.

CCCLX.

A fecond divifion of the fubclavian is the thyroid artery, which buds out from its root, where it is named the great axillary, in the form of a fhort thick ftump, and divides into four flender branches, which are diftributed to the thyroid gland, trachea, and adjacent parts.

CCCLXI.

The vertebral artery makes its third great divifion, which plunges into the vertebral hole, and contributes to the circulation of the head in the manner already noticed. It is fucceeded by two other branches, the deep and fuperficial cervicals, which are fpent moftly on the neck.

CCCLXII.

Thus, in enumerating the divifions of the fubclavian, the origin and progrefs of the mammary and diaphragmatic arteries are clear and diftinct. The vertebral artery goes to the brain, and the cervical ones to the mufcles of the neck, while the thyroid arteries fupply the fame place as well as the gland.

CCCLXIII.

After thefe branches follow the fuperior inter-
coftal, which fupplies the two firft ribs, being
about the fize of a crow quill. In its courfe it
runs downwards and backwards, and lodges itfelf
in the hollow where the fpine and firft rib are
joined. It gives off a number of fmall branches,
one part of which rifes to the neck, and another
is fent downwards. The fupra fcapulary is men-
tioned by fome authors as an important branch,
and often running off from the thyroid divifion.

CCCLXIV.

As the fubclavian artery enters the arm pit, it
is termed axillary, and from this place its diftri-
bution to the fuperior extremity proceeds. In the
hollow of the axilla it lies fafe, protected by the
pectoral mufcle before, and the latiffimus dorfi
behind, and furrounded with fat and glands.
From this part it gives off the thoracic arteries
to the cheft, and the fcapulary arteries to the
fhoulder. Proceeding in its courfe, the axillary
becomes foon changed to the brachial artery, and
this divifion is marked by the tendon of the great
pectoral mufcle. This appellation it receives till
it divides at the bend of the arm into the radial
and ulnar branches. It runs clofe along the os
humeri on its inner fide, where the bone is almoft
naked, and keeps exactly the interior furface of

the arm bone, giving off frequent branches in its course, three of which only deserve notice, the two arteries named profunda, and the great anaftomofing branch.

CCCLXV.

But the brachial artery thus defcribed does not immediately divide, even after it has paft the bend of the arm, but defcends deep into the fleſh of the forearm, and there its divifion takes place into three great branches, the radial, ulna., and interoffeous arteries.

CCCLXVI.

' The ulnar artery perforates the thickeft fleſh of the forearm, pervades the ulnar edge of the arm, appears fuperficial 3 or 4 inches above the wriſt, and goes down to the root of the little finger.

CCCLXVII.

The radial artery paffes in the manner of a branch from the ulnar, running to one fide. It is more fuperficial on the foreaim than the ulnar, and it turns backwards over the wrift, or root of the thumb.

CCCLXVIII.

The interoffeous is an ulnar branch: where this artery lies deepeft, it runs along the interoffeous, and fcarcely paffes the wrift.

CCCLXIX.

Each of thefe arteries poffeffes a particular branch, termed recurrent, correfponding to the

anaſtomoſing arteries elſewhere; which, ſo ſoon
as it has cleared the principal branch, returns
backwards to ſupply the joint.

CCCLXX.

The radial artery at the wriſt turns round it
over the head of the radius, and under the ten-
dons of the thumb; and, before paſſing, it ſup-
plies the branch to the palm. When paſt, it
ſends off the artery of the back of the hand.
Branches are then ſent to the back of the thumb,
and in its progreſs at the cleft betwixt the thumb
and forefinger, it divides into three great branches,
one to the inner ſide of the thumb, another to
the forefinger, and the third into the palm of the
hand; forming on the ſide of the palm, next the
little finger, the celebrated inoſculation betwixt
the upper and lower arches.

CCCLXXI.

The ulnar cavity, as it runs along the tendon
of the flexor carpi, turns over the wriſt at the
piſiform bone; from this it forms the ſuperficial
arch of the palmar arteries, and ſupplies all the
fingers, as the radial does the thumb. It ſends
alſo a dorſal trunk round the back of the hand to
the little finger.

CCCLXXII.

Such is the general diſtribution of the ſub-
clavian to the trunk and ſuperior extremity; and

In confidering the origin of the fubclavians from the aorta, the right one is more directly oppofed to the mouth of the ventricle of the heart coming off from the aorta, where it is about to make the turn, whereas the force of the blood is broken by the turn before the other branch of the left fide comes off. As mankind then, in general, prefer the right arm, there appears a connection with this fact, which may be received as caufe and effect. This circumftance is a very curious one. The more the matter is confidered, the more is it founded. For on comparing the nerves of both arms, they are of the fame fize, exactly connected in the fame manner. The only final caufe of the preference is perfectly evident, that by exercifing one arm more frequently, we acquire much more dexterity. But we muft find an efficient caufe, or fomewhat to determine us to ufe the one originally in preference to the other; for the great ufe proceeds not from reafon. Children give the fame preference, and we find it univerfal.

CCCLXXIII.

To this effect of the diftribution it may be added, that though motion does not primarily depend upon the blood veffels, it does fo in a fecondary degree. The nerves exert their energy more powerfully by the quantity of the blood difperfed along them, and have feen many more veffels in the organ of

fmell than we can well find ufe for. Now this
trunk receives the blood with greater force and in
greater quantity, and taking its rife in a common
trunk, the refiftance is much lefs, without at all
alleging that the right fubclavian is occafionally
conftructed larger than the left; the blood runs
through the common trunk with greater eafe than
through the fecond and third branches, and there
is lefs refiftance made by the fides of the veffels.
And to compare this with the cafe of other
animals, notwithftanding the neceffity they are
under in walking to ufe the two anterior ex-
tremities exactly in the fame manner, yet in them
there is a preference: thus it is a very difficult
matter to force a horfe to walk with his left
fhoulder foremoft, he naturally prefers the right
fore extremity.

CCCLXXIV.

In birds, this preference would have been
hurtful, and would have brought them to the
ground, juft as the cutting the fmalleft bit of
one of the wings, by the leffening the furface,
and thereby the force; whereas, when we cut
an equal portion of both, the bird readily fup-
ports itfelf. In birds, then, the aorta fends off
two branches, and thefe are again equally fub-
divided. Hence there is great room to fuppofe,
that this diftribution of the arteries allowing the
blood to enter more perfectly and free to the

right arm, and perhaps to return more readily from the arm, gives the preference; and that it is stronger, and therefore originally preferred.

CCCLXXV.

When we follow the subclavian a little further, we find small branches sent off to the thorax, upper part of the shoulder, and lower part of the neck; after which the artery passes under the clavicle, and hence it is named properly, subclavian, passing between the clavicle and right rib, and we can at this place readily distinguish the pulsation, so experiments may be made, which may be useful, in a variety of cases, to stop the blood in the subclavian artery by a very slight pressure. If the thumb is put upon it above the middle of the clavicle, and pressed downwards against the first rib, the pulse ceases immediately, which is scarcely attended to by surgeons. Now, if an accidental wound in any of the large branches coming off near to the axilla take place, or in the external thoracic arteries, and if the surgeon is not provided with instruments for taking hold of the bleeding vessels, or if there is an aneurism in the axilla where there is no possibility of applying the tourniquet in the ordinary way, or if we are taking off the superior extremity at the joining of the humerus with the scapula, by making a pressure here we may prevent the great loss of blood.

CCCLXXVI.

Following the artery a little farther, we find it get into the axilla; and here it is protected by the pectoral muscle and latissimus dorsi, stretched across from the trunk to the body of the humerus, whereby the artery receives considerable protection, and the arm is much less wasted in persons that use crutches.

CCCLXXVII.

Next, from its situation between the round ball of the humerus and ribs, where a luxation happens downwards and inwards towards the axilla, the artery may happen to be very much compressed; and from this, independent of other circumstances, the arm may lose very considerably of its strength. From the pressure of the nerves here, a numbness is very often brought on, and this even continues sometime after the bone is reduced, the nerves being injured from the pressure it has suffered.

CCCLXXVIII.

Lower, we find the axillary glands connected to the artery by cellular substance; and where these are enlarged in a diseased state, there must be the utmost caution used in attempting to separate them from the artery, and the surgeon is under the necessity of tearing them away with the fingers, instead of using a knife.

CCCLXXIX.

Lower than this, the artery runs parallel with the os humeri, therefore is now named, humeral artery; and, in its whole course, is almost fub-cutaneous, or is not covered by any confiderable mufcle, but by the fkin, cellular fubftance, and that condenfed with a thin aponeurofis fent off from the mufcle, fo we can diftinguifh the ftroke of it, through the whole way down the humerus, and are able to comprefs it in its whole courfe with the tourniquet; and the blood is more eafily ftopped here than furgeons generally apprehend. The tourniquet need not be drawn with great force, a very flight compreffion may be fufficient. And nature, in the whole courfe, has difpofed the artery in the place of the extremity that is evidently the fafeft, running down parallel to the biceps at the inner fide of the humerus, where it is leaft expofed to injury. At the lower part of this bone, an addition is made from the tendon of the biceps; the aponeurofis is now very confiderably thicker.

CCCLXXX.

After the artery has run about ¼ of an inch under the bend of the elbow, it divides into the ulnar and radial branches; and following thefe into the hand, we find large communications of the arteries with each other; we find a fuperficial and deep arch; or, fuppofe an oval, or a circle, to be

made by the arteries around the tendons of the hand, that circle into one side of the trunk of the radial artery is opened with a small branch of the ulnar; and into the other trunk of the ulnar with a small branch of the radial; so that the blood may flow freely from the radial artery acrofs thefe arches into the ulnar, and afcend in the ulnar in its whole length. From this merely we might conclude, that where radial or ulnar arteries happen to be wounded, the furgeon cannot ftop the blood by gently compreffing the artery, or by fqueezing the fides of it together, but we may tie the wounded artery above and below the wound, and the circulation remains free through the whole member.

CCCLXXXI.

If the middle of the radial artery is wounded, all below would be fupplied with the blood defcending through the ulnar, and coming upwards from the arches into the radial. From the anaftomofes we fee alfo the neceffity there will be, where thefe are to be ftopped by ligatures, of making two ligatures, otherwife the bleeding will defcend through the other branches, and get back to the wound. Not but that the bleeding may ftop of itfelf by the coagulation of the blood at the mouths of the veffels; by their contractions, and by the fwelling of the neighbouring parts, though it receives the direct impulfe of the heart, and it

may be stopped more readily by the same means
where the impulse is more indirect. But if we
had no facts to support us, we could scarcely
venture to draw any further conclusion with re-
gard to the danger of wounds made in the trunk
of the humeral artery. Merely reasoning upon
it, we would suppose, that if the trunk is
wounded, the limb under the wound could not
be nourished, because the anastomoses are so
small, that there could scarcely be a sufficient
quantity of blood for that purpose; but ex-
perience determines otherwise, and we know
certainly, from a number of cases, that after the
humeral artery has been wounded, we may tie it
in two places, and yet the motion of the blood
continues through the arm in such quantity as is
sufficient to maintain the common functions of
the part. Hence, where a wound has been in-
flicted higher than the joint of the elbow, and
there has been an uncommon division and only
one of the branches has been wounded, or that
the wound is more general on the radial branch,
the trunk is more exposed than that branch, be-
cause the skin is thinner at that place, at the
place of our flexion, in consequence of which the
artery pushes forwards, and it is supported on
the swelling of the extremities of the bones;
whereas the radial branch sinks deeper between
the muscles, and begins lower than the place

from which furgeons generally draw blood. Thus, in moſt caſes, the trunk is found evidently opened; and, by the accounts of authors, the wound is always found to be feveral lines or parts of an inch above the diviſion. Or take another view where the operation even has been performed in an unguarded manner; the patient has ſuffered very exquiſite pain, becauſe the furgeon included the large radical nerve which is contiguous to the trunk, and, where the trunk divides, it follows the ulnar branch, not the radial; and the name of radial nerve ſeems to have miſled ſome who have not ſeen this argument.

CCCLXXXII.

Thus it is ſufficiently eſtabliſhed, that the fore arm can be nouriſhed by the lateral branches or recurrent veſſels, taking their riſe from the radial, ulnar, and interoſſeous arteries; and theſe gradually come to be dilated. Very often the dilatation is made before the operation is performed; and this explains a circumſtance which has appeared very perplexing to furgeons; that, immediately on making a preſſure upon the trunk of the artery by the ligature, the pulſe ceaſed in the veſſels at the wriſt, but in the ſpace of a few minutes it could again be felt. For in the time of the operation, without ſuppoſing the faintneſs, there is a loſs of blood, the veſſels are emptied, the furgeon ſlackens his tourniquet, then ties the thread, and it re-

quires fome time before the blood has defcended
fo as to convey the impulfe of the blood in the
heart.   But if the difeafe has continued fuch a
length of time as to make fuch an enlargement of
the trunk, if the tumor preffes this arteiv againft
the bone, the branches will be dilated, fo in a few
minutes they are filled and the impulfe communi-
cated. But where the preffure is not confiderable,
fo as greatly to interrupt the flow of the artery,
the pulfation commonly ceafes for feveral days, till
the lateral branches come to be dilated.   The
recurrent branches have been even feen dilated to
the fize of the end of a common probe.

CCCLXXXIII.

Having thus proved that the trunk of the artery
may be tied at the elbow, it may be concluded
that that operation may be as well applied to any
other part of the fuperior extremity.   Or, if we
now return to the diftribution of the veffels, at
the upper part of the arm we find a communi-
cation made nearly in the fame way, a fuperior,
and pofterior fcapular artery ; and getting lower,
we find a number of fmall branches, &c.   And
to fhew this more clearly by an experiment, the
trunk of the humeral artery may be tied in two
places, and cut between them, fuppofe about the
middle.   An injecting pipe is then to be fixed
higher than the place cut, and fquirting in water,
air, or milk, we can feel all the inferior branches.

Thus the operation which is done near to the elbow, may be practifed any where in the upper part of the humerus with nearly the fame fuccefs, only a greater portion of the member needs to be nourifhed. And cafes have occurred that prove it in the moft abfolute manner. An aneurifmal fac has occafioned a concretion of the fides of the humeral artery near to the axilla, an effect the fame as that of the ligature, and a proof that the artery may be tied above this ruptured place. Even from this, however, it does not follow with an abfolute certainty, that any arm may be faved though the humeral artery is tied to that height; the concretion muft be gradual in proportion to the increafe of the aneurifmal tumor, fo the lateral branches will dilate by degrees; but in the cafe of a wound, the branches may not be fufficient to convey the neceffary quantity of blood. But, inftead of immediately proceeding to amputation, we fhould attempt to fave the arm.

CCCLXXXIV.

Having now attended to the common divifion of the artery, it is of ufe to obferve, that *lufus naturæ* are more frequent than anatomifts are aware of. Dr. Haller imagines that they have not been fo frequently obferved as they are defcribed. But inftead of that, fuch may happen, upon the whole, in one of twenty perfons; and a furgeon ought to look for it as in performing

the operation of the aueurilm; efpecially that the two branches may clofely accompany each other, and fo both may be taken up. But if the furgeon is aware of this, the two branches may be lepa-rated with the greateft eafe, and the fuccefs of the opeiation thereby infured, though the fupply is the fame as where one of the arteries happen to be wounded. In fome cafes they are afterwards united by a ciofs canal; but we are to take it for granted, that the fupply is made through the fmall anaftomofes or arch in the ball of the hand; and the neceffity of larger anaftomofes is evident, that part being more expofed to compreffion, and the ftagnation of the blood in the veffels.

CCCLXXXV.

One further *lufus naturæ* ought to be obferved, that it fometimes happens that where the common divifion is made, the arteries, inftead of remaining contiguous to each other, feparate, and one of them is fubcutaneous. There may be a danger, therefore, of opening an artery inftead of a vein; particularly we ought to be cautious where we are about to open the branch in the courfe of the baflic vein.

CCCLXXXVI.

Having fully confidered what belongs to the arteries, let us next take the veins into review.

CCCLXXXVII.

Ï the confiderable arteries are accompanied by

correfponding veins. Thefe are more numerous
than the arteries; taken together, they are larger;
but taken fingly, they are fmaller : for there is
no vein as large as the humeral artery for ordi-
nary accompanying it, but two or more veins, and
thefe frequently joined together, and the whole
crouded with valves. Befides the accompany-
ing veins, there is feen a fet of fubcutaneous veins,
which are upon the whole larger than the deep
veins, and thefe likewife are crowded with valves,
notwithftanding that they run upon the furface of
the mufcles, and we fee numerous anaftamofes
between the deep and fubcutaneous veffels. All
the circumftances clearly confirming, as with re-
gard to the ufe of the valves, that they ferve to
determine the blood to the heart; that, although
the moderate action of the arteries and mufcles
promotes the flow of the blood in the veins; yet,
if that action is greater, we ftop the flow almoft
entirely. When the mufcles are acted with, the
fubcutaneous veins immediately fwell, the blood
being no longer able to get along the internal
veins with freedom. Hence, in letting blood,
the patient is directed to move the fingers; and
if the motion made is flow, we fee the blood
flowing fometimes in the fubcutaneous veins, *per
faltum*, and producing an alarm as if an artery
had been opened. There is at the outer fide the
cephalic vein, upon the inner fide the branch

forming the bafilic, and between thefe, the me-
dian cephalic and median bafilic. If then the
fituation of the arteries alone is refpected with
regard to the veins and the tendons, and if the
tendons are very fenfible, we would let blood moft
readily in the cephalic or median cephalic vein.
But, if it fhall appear that the tendons have little
fenfibility, and that the danger of wounds, inde-
pendent of the artery, arifes from punctures of
the fubcutaneous nerves, we would perform the
blooding moft frequently in the median bafilic;
and, as this vein is of confiderable length, though
it croffes the artery, you will always find room
for opening it without making the orifice imme-
diately over the artery: it does not run fo much
longitudinally, but we may keep it $\frac{1}{4}$ of an inch
diftant.

CCCLXXXVIII.

To finifh the examination of the parts defcribed,
their nerves come laft into review. The exit of
the firft nine pair or the cerebral ones, was already
noticed. The 1ft pair, or olfactory, the moft
tender in their ftructure of the whole, we found
form a beautiful plexus fpread out on the mem-
brane of the nofe. The 2d, or optics, of a pure
white texture, enters the orbits in a waving di-
rection, and penetrates the eye-balls, to be ex-
panded on the retina. The third, or eye-movers,
paffing out at the foramen lacerum, divides into

branches which supply the ocular mufcles, and form
a fmall opthalmic ganglion. The 4th, or pathetic,
the moft flender of the whole, is diftributed on
the trocholearis mufcle. The 5th, or trigeminum,
the largeft of the whole, forms the femilunar
ganglion by the outfide of the cavernous finus,
and from this ganglion fends out three large
branches, the opthalmic and two maxillary, which
are again divided into an infinite number of fub-
divifions. The 6th pair are expanded on the
abductor mufcles of the eyes. The 7th pair, next
to the olfactory, is the fofteft nerves in the body,
and is diftributed in two portions on the ear and
face. The 8th pair is fpread out on the neck,
tongue, pharynx, and adjacent parts. The 9th
pair is diftributed chiefly to the mufcles of the
neck and tongue.

CCCLXXXIX.
Great Sympathetic Nerve.

After this origin and primary diftribution of the
cerebral nerves, falls to be noticed the great
fympathetic, connected with moft of the nerves
of the body, and arifing from a reflected branch
from the 2d of the 5th pair, and from fome fmall
filaments of the 6th pair. It is expanded in its
courfe along with fome other nerves into a large
ganglion on the neck, termed the fuperior cervical
ganglion. At the under part of the neck it forms
in the fame manner another ganglion, termed the

medium, or inferior cervical ganglion, similar in
most respects to the former, but admitting some
variety in different subjects.   From this ganglion
principal branches are sent out, one of which, or
the proper continuation of the trunk, passes to a
3d ganglion placed at the head of the first rib,
and therefore the first of the thoracic ganglia.
From all these ganglia a variety of nerves are
sent off to the different adjacent parts, and which
derive their name from their connections or dif-
tribution.

CCCXC.
Accessory Nerves.

The accessory nerves to the 8th pair come the
next in course, arising from the medulla oblongata
and upper part of the spinal marrow.   After per-
forating the cranium they observe an oblique de-
scent through the sterno-mastoid muscle to the
shoulder, from which they send branches to dif-
ferent parts.

CCCXCI.
Spinal Marrow and Nerves.

We thus descend to the spinal marrow which
is chiefly to be considered as the production of
the lengthening out of the medullary substance
of the brain and cerebellum; but, upon cutting
it transversely, a small proportion of cortical or
emeritious substance may be observed resembling
that of the brain.   The nerves are next every
where in the whole length of the spinal marrow

in pairs, and every nerve has two origins, an anterior and pofterior one. Bundles of threads compofe the fpinal marrow, and thefe are covered where they are about to go through the holes of the vertebræ by the dura mater, and at that place there is an enlargement, a ganglion or knot, bigger than the threads that form it, or than thofe that go out from it. Beyond the knot we find the nerves fpread into anterior and pofterior branches; the anterior are the largeft, and all of them communicate with the nerve above and below. Now, from this circumftance, it is in vain, till more pains are taken, to pretend to determine exactly the mufcles on which each pair of nerves terminates: we find all of them joined to one another.

CCCXCII.

The fpinal nerves are diftinguifhed on each fide by numbers, according to the bones under which they pafs. They proceed the length of 30 pairs. Of thefe, one paffes under the head, termed fuboccipital, feven go under the vertebræ of the neck, twelve under the dorfal vertebræ, five under the lumbar, and five are fent from the pieces of the facrum.

CCCXCIII.

The fafciculi which compofe thefe nerves, vary in the different divifions in their length, and in the direction of their courfe; fome running ftraight,

and others running oblique. The fize alfo of the
fafciculi correfponds to that of the nerves they go
to form. The lumbar, and feveral fafciculi in-
cluded in their covering, compofe a bundle of
cords, termed the cauda equina, from its refem-
blance to a horfe's tail.

CCCXCIV.

The circulation of the fpinal marrow is fupplied
by its own arteries, the anterior and pofterior fpi-
nal ones, which receive many additional branches
from the adjacent parts.

CCCXCV.

The anterior fpinals arife from the vertebrals;
and upon the beginning of the fpinal column they
unite into a common trunk, and the artery con-
tinues nearly of the fame fize throughout, re-
ceiving additions from the neighbouring veffels.
In the neck the fpinal trunk communicates with
the vertebral, thyroid, and cervical arteries. In
the back it receives branches from the intercoftal,
and in the loins from the lumbar arteries. It ter-
minates at the under end of the fpinal marrow.

CCCXCVI.

The pofterior fpinals arife from the arteries
within the head. They are of the fame length
with the anterior, but are lefs in fize, and con-
tinue feparate through their whole courfe. They
obferve alfo a feparate direction, and frequently

inofculate with trunks connected with the anterior
ones.

Thefe arteries of the fpinal marrow are fub-
divided into moft minute divifions fpread upon
every part of its fubftance and its membranes.

The veins accompany the arteries, and termi-
nate in the venous finufes of the fpine.

CCCXCVII.

Thefe finufes confift of one on each fide, which
runs exterior to the dura mater lodged in the
ligamentous membrane which lines the vertebral
canal.   They extend from the occipital foramen
magnum to the under end of the os facrum, and
from their irregular appearance and fubdivifions,
they in many places poffefs the appearance of cells.
At the different vertebrae they are conjoined by
crofs branches of a femilunar form, and at their
upper occipital extremity they communicate with
the occipital and lateral finufes of the head.

CCCXCVIII.

From the fpinal nerves, now confidered, we
proceed to thofe of the neck.   And, in general,
we obferve of the fpinal nerves, which take their
rife from the fpinal marrow, that they begin by
two diftinct bundles of fibres, an anterior and
pofterior bundle.   Thefe come to be joined to-
gether, and are covered by the dura mater; but
further, where they meet, there is a knot or fub-

ftance, which anatomifts call ganglion, the na-
ture of which is not perfectly underftood.   From
the ganglion branches are fent off, and all the
anterior branches are connected by arches, which
reprefent the anaftomofes of blood veffels, but
are perhaps very effentially different.   From thefe
are bundles of them tied together in one fheath.

CCCXCIX.

Befides the connection which the cervical and
fpinal nerves have by their anterior branches, the
neck produces alfo, as already noticed, a nerve
named acceffory, which runs upwards into the
head, comes out with the eight pair, is again
connected with the other cervical nerves, and,
laftly, all the cervical nerves are joined to the
great fymphathetic, or intercoftal one.

CCCC.

The general purpofe of this is, to prevent the
nervous energy from being intercepted; which is
fully difplayed in the lower cervical, or brachial
nerves, which are firft joined together by their
anterior branches, and afterwards feparated again,
and a fecond and third time reunited; or we
obferve a very curious plexus formed by them
under the clavicle, and down into the axilla, what
anatomifts have named axillary plexus.   It is no
greater an enlargement than what might have
been expected from the fize of the nerves running

together; and we can diſtinctly trace the nerves through the plexus, ſo as to determine the nerves of the neck from which every muſcle is ſupplied. Thus, if from two nerves, ſuppoſe the two firſt, the fourth, and fifth of the neck, nature intends to ſupply two muſcles that are antagoniſts, the biceps flexor and triceps extenſor, inſtead of the fourth nerve ſupplying the one, and the fifth the other, the half of each is ſent into each muſcle, and neither the fact nor reaſon of it has been properly attended to. It is plain that this is to guard againſt accidents; that if one nerve is divided, inſtead of loſing altogether the uſe of the flexor, or extenſor muſcle, we loſe the half of both; and it is better to be able to extend and bend the arm with half the force, than to have the whole flexion without the power of extenſion. It is not to enable us to act more freely; there is no foundation for that ſuppoſition. We find it univerſally maintained, that the ſuperior troch-learis muſcle receives a nerve, that we may act readily and eaſily with that. But there is ſome other ſecret purpoſe to be ſerved; and we find the nerves ſupplying different muſcles carefully united, the union repeated, and antagoniſt muſcles ſupplied from the ſame roots, and the ſame muſcle, when of unuſual length, ſupplied from a number of nerves.

CCCCI.

Nerves of the Superior Extremity.

The cervical nerves, in getting into the axilla, form an irregular plexus, termed the axillary, or brachial, which furrounds the place of the artery; and this plexus fends branches to a number of the mufcles, and furnifhes alfo the external thoracic nerves: after this it divides into nerves of great fize, which fupply fenfation and energy to the fuperior extremity. Their number is confiderable, and their diftribution intricate and extenfive. When the principal or radial nerve reaches the hand, it comes off in three divifions, from which feven nerves of confiderable fize arife for the fupply of the thumb and fingers. When the fecond branch or ulnar reaches the fame place, it is chiefly expended on the back of the hand. Befides the brachial plexus fupplying the fuperior extremity, this member alfo derives fome addition from the intercoftals.

CCCCII.

On the nerves of the fuperior extremity it may in general be obferved, that the ufe of knowing their particular fituation is evident, as in treating various cafes of convulfion and paralyfis, and in performing furgical operations, that we may avoid them, becaufe they are never wounded or punctured without evident danger. And in proof of this, we need only attend to the bad con-

fequences from wounds of the fmall branches, and particularly thofe following blood-letting performed about the elbow.

CCCCIII.

From the extremity, we return to trace the nerves of the thorax, which, on each fide, confift of the phrenic, or diaphragmatic part of the 8*th* pair, the great fympathetic, and the intercoftals: Of thefe, the intercoftals and diaphragmatics fupply the pleura, or invefting membrane, with fmall twigs. The heart, the principal organ, derives its energy chiefly from the great fympathetic and 8*th* pair; and from the fame fource is fenfibility conveyed to the lungs. In the diftribution of the nerves here, feveral important plexus are formed. The 1*ft* is the anterior pulmonary plexus, which extends acrofs the great branches of the pulmonary artery. The 2*d* is the pofterior pulmonary plexus, which lies behind the root of the lungs. The 3*d* is the æfophageal plexus, which furrounds the æfophagus, and afterwards going through the diaphragm, is fpent upon the abdomen. The 4*th* is the great cardiac plexus, formed by a number of nerves, and particularly neceffary to the exercife of the functions of the organ. Befides which, we find a leffer cardiac, and two coronary plexus.

CCCCIV.

Thus the heart, as the principal organ, receives its fupply from no lefs than thirteen feparate

twigs or branches at leaſt ; and, beſides the nerves that deſcend, we are not certain but there may be others that aſcend and enter into the ſubſtance of the heart. Upon the whole, we can obſerve, that nature carefully guards againſt the want of a proper energy. Thus, if from any accident or diſeaſe a part of its force ſhould be loſt, it is better that this ſhould be general, than that any one part ſhould be rendered paralytic. Hence the heart derives its nerves from a number of organs, and theſe are intermixed by the inter-vention of ganglia, a further energy proceeding perhaps from theſe.

CCCCV.

From the conſideration of the importance of the organs upon which theſe nerves are ſpent, the danger of wounds in the nerves upon the neck is perfectly evident. If a conſiderable proportion of them is tied, the animal ſoon dies; and, inde-pendent of the danger which attends the ligature or diviſion of theſe nerves, we have reaſon to believe that there is the utmoſt danger to be ap-prehended where the 8th pair and intercoſtal run, upon their being expoſed to the air, from an in-flammation taking place, that alone will be found often fatal. Hence we are not raſhly to under-take operations here. As for the aneuriſm in the carotid artery, ſuppoſing it to be ſmall, and that it is in the ſurgeon's power to tie the artery in

two places by such a ligature on the carotis
communis the animal has been known to survive;
but, when any greater injury is done, the animal
dies, and in such cases these nerves are in an
inflamed state, and glued to the neighbouring or-
gans.

CCCCVI.

When we compare the branches from the 8*th*
pair with the proper dorsal or intercostal nerves,
we observe a great disproportion.   Perhaps all the
branches from the 8*th* pair on one side are not
equal to the size of one of the proper dorsal nerves:
and from this we may in some measure under-
stand what happens in practice.   It is a point
allowed, that what is called the pleurisy, the in-
flammation of the side of the containing parts of
the thorax, is attended with more pain and harder
pulse than the true peripneumony, where the in-
flammation is in the substance of the lungs.   This
may be in some measure explained.   Several cir-
cumstances no doubt concur; but, without taking
into account the difficulty arising from the inflam-
mation with which the blood passes from the right
side of the heart to the left to affect the pulse,
we would say that, from the greater number of
nerves sent to the side, its sensibility is greater,
and the system more irritated.   And one thing
further, perhaps, may have effect, that the proper
dorsal nerves are intimately connected to the

nerves which fupply the heart. Though, there-
fore, we do not fay that the fympathy depends
upon the connection of the nerves in their pro-
grefs, yet an inflammation fixing upon a branch,
more readily affects the neighbouring branches
than the diftant nerves of the body. Hence the
hardnefs of the pulfe, and the quick jirk, is owing
very much to the fenfibility from thefe large
nerves, which too is the c: _fe of the pain.

CCCCVII.

The whole fubftance, indeed, of the lungs
does not receive a nerve larger than one of the
proper dorfal nerves, the divifions of it therefore
muft be exceedingly minute, and the nerves of
the pleura very fmall. This is to be fufp(?·i
from confidering the ufe of the pleura, which,
with refpect to the ,urgs, is to give a ftrength to
them to confine the air, and prevent a rupture.
Another ufe is, that the lungs in refpiration may
play upon the ribs, the pleura is interpofed to
leffen the attrition, fo that it is made for attrition.
Now, do we perceive, either from the one ufe or
other, any neceffity for fenfibility? A highly
fenfible membrane cannot be interpofed for either
purpofe.

CCCCVIII.

Upon the whole, though the pleura has nerves,
becaufe it has veffels which are actuated by the
nerves, yet thefe are fmall and inconfiderable in

number, yet it is capable of inflammation and of
concretion, which may be the fource of many
diforders; but we are not to believe that merely
the infl mmation of the pleura is capable of occa-
fioning fatal fymptoms, and that thefe depend
almoft entirely upon the affection of the nerves of
the fide, which are large and numerous, and
which it is not in our power to relax, and which
we cannot altogether refrain from ufing. Where
the pain is feated entirely in the lungs, the patient
will fuffer the higheft degree of danger when the
fl mmation occupies the deepeft part of the
lung, both on account of the fenfibility of the
hea, and of the diftribution of the nerve

*   II.

CCCCIX.
Nerves of the Alimentary [...]

The nerves of the chylopoetic vifcera are formed
by part of the 8th pair, and of the great fym-
pathetic

The covering, or peritonæum, derive branches
from all the contiguous parts, but their number
is fmall, and they are unimportant they confift
of twigs from the inferior dorfal, the lumbar, the
great fympathetic, and facral

CCCCX.
The two nerves compofing the 8th pair, after
fupplying the lungs, run upon the æfophagus. In
their courfe downwards they fplit into branches

and from the oppofite fides the branches are
united. That branching and joining is repeated
feveral times before we get down to the ftomach,
fo that we are at a lofs to determine from which
fide a nerve of the ftomach comes; in general
they come from both fides. And we find an an-
terior and pofterior bundle called plexus; but we
are only to underftand that feveral nerves are
included in the fame fheath, but without knots
or ganglia being formed. The remainder of the
8th pair paffes from the back part of the ftomach
to the aorta, and joins it as foon as poffible about
the root of the cæliac artery.

CCCCXI.

In tracing the great fympathetic, it runs down
the thorax, and is joined to the proper intercoftal
nerves. About the middle of the thorax branches
are fent off, which uniting, form a confiderable
nerve that is fpent almoft entirely upon the abdo-
minal bowels, fo named the ramus fplanchnicus.
The rami fplanchnici take the fame direction with
the pofterior branches of the 8th pair, and they
are joined to each other acrofs the aorta, and at
the fame time they receive the 8th pair, fo that
thefe nerves meet about the cæliac artery; and
at the meeting we find a prodigious enlargement
without any evident caufe; we would fuppofe that
it is a clufter of fmall conglobate glands, or we

find ganglia, and from its appearance it is called the femilunar ganglion.

CCCCXII.

From this ganglion nerves are fent off to all the chylopoetic vifcera; and, as thefe fcatter as they proceed towards the different bowels, there are others who call this fubftance plexus folaris, like the fun fending out radii to all fides. The nerves from it proceed along the arteries, are conducted by them, forming a net-work that we would take for cellular fubftance, and take their name from the arteries they accompany, as the plexus cæliacus mefentericus.

CCCCXIII.

This femilunar plexus in which the feveral nerves, are united, is much larger than we might have expected, or fomething more is done here than in feveral other plexus, where we can trace the fibres diftinctly, whereas here we lofe them. And, without fuppofing that there may be fomewhat added to the nervous energy in the part, or that fome purpofe is ferved different from what the brain itfelf fupplies, we find here an intimate mixture and incorporation of all the brain running downwards, nature guarding again total interruption of the nervous energy in that are neceffary to life. Thus it is better to lofe the thirtieth part of the nervous energy of

the alimentary canal, than to lose the total power
of the thirtieth part of the length of it; for,
should a paralysis of a single foot of it take place,
there would be an interruption to the discharge of
the aliment, the action of the muscular coat of
the alimentary canal contributing in a very prin-
cipal way to this. So we may say, that in the
semilunar ganglion there is an intimate mixture
of the several nerves, and we may consider these
nerves as derived from a number of sources, from
the intercostal, connected with all the nerves of
the spinal marrow, and several from the head;
and the nerves may ascend from the lower parts
of the spinal marrow, so that some of the nerves
entering this ganglion may be derived from the
bottom of the os sacrum. From the nerves every
where accompanying the arteries, upon coming
out from this plexus we can understand the danger
arising from tumours near to the arteries, as in
the case of aneurism, there is not only danger
from it as affecting the artery, but from the ac-
companying nerve necessarily suffering.

CCCCXIV.

In considering the different abdominal organs,
the nerves of the stomach we find most numerous
in the cardia. The nerves of the stomach supply
also the omenta. Of the intestines, the nerves of
the small ones are most numerous. In the liver,
the same observation may be made, compared

with many of the other vifcera. In the fpleen,
the nerves are both numerous, and form an irre-
gular plexus furrounding the blood vefſels. In the
pancreas, again, they are fmall. In the kidney ,
like the fpleen, the nerves are both numerous,
and they form a plexus which furrounds the vef-
ſels, and accompanies them. This plexus fends
alfo branches to the renal glands. The bladder of
urine is fupplied by the facral nerves and great
fympathetic.

CCCCXV.

To finifh our examination of all the organs
contained in the thorax and abdomen, one only re-
mains, which has been hitherto purpoſely omitted,
as the reſervoir of a particular fyftem of vefſels,
the detail of which we as yet poftpone.

CCCCXVI.

This is the thoracic duct, a fmall membranous-
like canal lying in the back part of the thorax,
and forming the principal trunk of the abforbents.

CCCCXVII.

Thoracic Duct.

It is fituated behind the aorta, beginning upon
the 3d vertebra of the loins, and it croffes obliquely
from left to right till it gains the right fide of the
artery. Thus fituated, it forms an oval fanguine,
receptacle of the chyle ; and paffing between the
crura of the diaphragm, it afcends in the thorax
on the anterior part of the fpine, between the

layers of the mediastinum. At last crossing behind the upper part of the descending aorta, it emerges from the thorax to reach the under part of the neck. There it passes behind the internal jugular vein somewhat higher than the subclavian, and turning downwards, composes an arch ending in the cavity between the left jugular and subclavian. Into this duct is poured the chyle and lymph from all the colourless, or lacteal, and lymphatic vessels, to be discharged, as we shall afterwards find, into the red veins.

CCCCXVIII.

Having thus traced the circulation of the ascending and descending aorta, and the several organs they pervade, we again return to the abdomen to examine the organs of generation peculiar to the sexes, which still remain.

CCCCXIX.

Genital System of the Male.

In beginning the genital system of the male, our demonstration commences with the testes, which are two glandular bodies situated in the cavity of the scrotum, the body of the one being sometimes a little larger than that of the other.

CCCCXX.

This part, the scrotum, is a continuation of the common teguments, more abundantly supplied with sebaceous follicles than elsewhere, without any fat in its cellular substance, and forming a

bag, or purse as it were, over the testicles. Upon
its surface there is a superficial longitudinal pro-
jecting line, which divides it into two equal parts,
and is named its raphe. Its inner lining, or cel-
lular substance, is red, fibrous, and more con-
densed than elsewhere, receiving the name of
dartos; and forming a partition, or involving each
testicle singly, so as to prevent any direct com-
munication by means of a fluid or otherwise be-
twixt the two. By this outer covering of the
scrotum are the testicles supported and protected.

CCCCXXI.

Whether there be a foundation for the term of
dartos muscle, for expressing a muscle under the
skin of the scrotum, is doubtful. We see the
part possessed of considerable power of contraction,
and we observe a degree of redness here, but we
shall find, perhaps, that there is more muscular
power in our body than we are aware of. In par-
ticular, every part of our skin is muscular, for it
accommodates itself to heat and cold in the living
differently from what it does in the dead body;
but the motions of the testicle within the scrotum,
particularly when the scrotum is inflamed, does
not depend upon the dartos so much as upon the
cremaster muscle, which has such a connection
with the cellular substance, that the skin seems to
be moved by it, and it may promote the secretion
as well as the excretion of the semen. The sep-

tum ſcroti may be conſidered as cellular ſubſtance,
grown more denſe by having the layers preſſed
againſt one another.

CCCCXXII.

The internal coats proper to each teſticle, ſerve
alſo ſomewhat for the ſame purpoſe as the ſcrotum.
Theſe are the vaginalis and albuginea.

CCCCXXIII.

The vaginal coat is a continuation of the peri
tonæum, or abdominal covering, originally de
ſcending with the teſticle, and forming a ſheat,
or ſhut ſac round it, which has no communication
with any other part. In its manner of incloſure
it reſembles the pericardium of the heart, lying
every where looſe upon it, except where it is
connected with the albuginea behind, and to ſuch
an extent is that looſeneſs both above and below,
as to allow a proper and free motion of the organ.
By its external ſurface it is attached to the cre-
maſter muſcle, and thus to the inner ſurface of
the ſcrotum. It aſſiſts, as already noticed, in the
ſupport of the teſticle; and, by a ſecretion from
it, is the free motion of the organ preſerved.

CCCCXXIV.

Within the vaginal covering is the albuginea,
or white coat, which proceeds alſo from the peri-
tonæum, and cloſely inveſts the body of the teſ-
ticle, to which, internally, it every where firmly

adheres. It is a denfe, ftrong, inelaftic membrane, of a fmooth external furface, every where fpread over the teftes and epididymis, and conducting their veffels in the fame manner as the mefentery does thofe of the inteftines.

CCCCXXV.

The body of the tefticle next exhibits a yellowifh colour, and a pulpy appearance, of an oval form, with one furface a little flattened.

CCCCXXVI.

Epididymis.

At the outer and back part of the teftes lies their appendix, or the epididymis, inclofed in the fame covering with the tefticle itfelf. This part joins at the upper part of the tefticle by a rounded head. As it defcends it becomes flatter and fmaller, being attached behind to the body of the tefticle where blood veffels enter; but at its fore part it remains loofe, the tunica albuginea dipping here and forming a pouch. From the under part, where it forms by its firm attachment to the body of the tefticle the cauda minor, it turns backwards, and fends out the excretory duct of the tefticle.

CCCCXXVII.

The body of the tefticle, when examined, is formed of numerous veffels of every defcription, but its principal compofition is a collection of fmall tender elaftic filaments, intricately convoluted, termed the feminal veffels, or tubes; and

diſpoſed in bundles with partitions between them,
formed of vaſcular and cellular ſubſtance

CCCCXXVIII.

The commencement of theſe partitions is at
the root, or near the back part, of the teſticle;
and they extend in a radiated manner to the
albuginea. Behind, the teſticle is fixed by its
veſſels, forming the ſpermatic chord. Before, it
is looſe and free. From the ring of the external
oblique muſcle, the chord extends to the body of
the teſticle, being the united trunks of the different
veſſels of the teſticle increaſed by a quantity of
cellular ſubſtance. The cremaſter muſcle alſo
covers the chord, and the peritonæal continuation
internally from the vaginal coat is ſo cloſely con-
nected as to form a part of it. By the manner
in which theſe coats are ſpread no fluid can paſs
from the chord to the teſticle, or take the oppoſite
direction. The circulation of the teſticle takes
place by means of the ſpermatic arteries which
ariſe on each ſide from the fore part of the aorta,
a little below the renal arteries. They croſs the
pſoas muſcle and ureter, and deſcend to the
under part of the belly behind the peritonæum,
where perforating the ring of the external oblique,
they paſs into the ſpermatic chord. In their
paſſage they give branches to the adjacent parts,
and are much intermixed with their correſponding
veins.

CCCCXXIX.

After this paffage of the rings, they foon divide into very fmall arteries for the feveral parts of the tefticle, to the amount of four or five. Two of thefe go to the epididymis, and two large ones to the tefticle; one of which moves in its upper part in a beautiful ferpentine form under the epididymis, and fends coronary branches down all over its furface. The fubdivifions of thefe are at laft minutely diftributed upon the furface of the feminal tubes.

CCCCXXX.

Befides the fpermatics, a fmall branch from the hypogaftric accompanies the vas deferens, and is difperfed along with the other artery.

CCCCXXXI.

The veins of the tefticle are greatly larger than the correfponding arteries, and difcover feveral valves in their diftribution without the abdomen. They form a plexus on each fide of the artery, fo as to refemble the fhoots of a vine. As it afcends in the abdomen, it forms at laft into a fingle trunk on the right fide, terminating in the vena cava, and on the left fide in the renal vein.

CCCCXXXII.

To enter more minutely into the ftructure of the tefticle, we find the feminal tubes of a cylindrical form, dividing into branches, and when drawn

out they extend to an amazing length. They are collected first into larger, and then into smaller bundles, till each of the smaller is formed into a single tube, coiled up in a conical form ; and from the convoluted tubes, straight vessels, or vasa recta, are sent out in equal number, forming an irregular plexus, or net-work, termed rete vasculosum. This net-work sends out again from 12 to 18 straight tubes, or vasa deferentia, which carry the semen from the testicle to the epididymis. These straight vessels then become convoluted, and form conical bundles, or coni vasculosi, firmly connected by cellular membrane, and which compose more than a third part of the epididymis. They at last unite into a single tube, which, constituting the most of the epididymis, forms the passage for the transmission of the semen. In its course it enlarges, becomes less convoluted, and, expanding its structure, it comes out in a straight direction, under the name of the vas deferens.

CCCCXXXIII.

Vesiculæ Seminales.

From the epididymis, we are led to the vesiculæ seminales, two pyriform receptacles, situated between the bladder and rectum, at a considerable distance from each other, and each composed of a convoluted tube with irregular processes, surrounded by vessels, nerves, and cellular membrane. Internally, they consist of irregular cells,

which communicate freely with each other, though varying in fize and appearance in different fubjects.

CCCCXXXIV.

Between thefe veficles the vafa deferentia become cellular, and expand, paffing forward till they arrive it the proftate gland, where they freely communicate with each other. Here a fmall canal is fent out from each of them, which pierces obliquely the proftate gland, and terminates in the under part of the neck of the bladder. The orifices of thefe canals are feparated from each other by a caruncle, or round projection of the membrane of the urethra, termed the veru montanum.

CCCCXXXV.
Proftate Gland.

The proftate gland lies immediately under the fymphyfis of the pubis, refting upon the rectum. It clofely embraces the neck of the bladder and beginning of the urethra. In fize it is equal to a walnut, and in fhape like a heart on cards, with its bafe to the bladder, and point to the penis. It is a firm gland, with fome fpongy fubftance, and it fends out no lefs than 10 or 12 ducts, which open obliquely at the fides of the urethra and adjacent parts.

CCCCXXXVI.

The circulation and nerves of thefe parts is

supplied by the same vessels that supply the genital system in general.

CCCCXXXVII.

In examining the uses of the parts described, we find, that while the convoluted structure of the testicle separates the semen from the spermatics, it is carried to the epididymis, and thence through the vas deferens by a long and slow course into the vesiculæ seminales. The use, however, of the vesiculæ seminales is undetermined, and they are supposed rather to separate a particular mucus essential to the perfection of the semen in its passage, than as serving merely for a receptacle of it. The secretion of the prostate gland serves also in a similar manner some useful purpose, of which conjecture only can be formed.

CCCCXXXVIII.

Thus the semen passes upwards through the testicle, then through the epididymis, to be deposited in the vesiculæ seminales, into which it regurgitates from th vas deferens, as the gall to the gall bladder from the liver; and, by a reverse motion, when necessary, it is thrown into the urethra. Near to the mouths of the seminal ducts we find the mouths of the prostate glands opening; and also Cowper's glands, the nature of which we do not pretend to explain: and in the whole course of the urethra, we find tubes pouring out mucus to defend the passage from the acrimony of the

urine, which, as it advances, preffes out the mucus from them; and thefe are, beyond all doubt, generall} affected in the gonorrhœa, though that difeafe may alfo affect the other parts.

CCCCXXXIX.

Penis.

The penis, the next part that follows, is compofed of three fpongy fubftances, two of which form the body of the penis, or the upper part, termed its corpora cavernofa, and the third furrounds the urethra, named its fpongy body. They are all covered with a continuation of the common teguments, which are thinner than elfewhere, and which poffefs below a quantity of cellular membrane without fat.

CCCCXL.

Thefe teguments form at its anterior extremity a loofe fold, named the prepuce, which is connected to the glans, or under and anterior part, by a triangular fold or bridle, termed l .frænum.

CCCCXLI.

In their fhape, the corpora cavernofa refemble two irregular cylinders clofely applied to each other, covered by a ftrong ligamentous fheath with tranfverfe and oblique fibres. They arife alfo by two crura, or conical extremities, from the crura of the offa ifchii and pubes, to which they are connected by ligamentous fubftance. At the

under part of the fymphyfis they form a union which continues till they terminate in the glans or rounded extremity.

CCCCXLII.

From the upper part of the root of the penis proceeds a triangular procefs, connected to the fymphyfis, and named the fufpenfory ligament of the penis, by which its body is fupported, and its preffure upon the fcrotum prevented.

CCCCXLIII.

The principal vein of the penis runs in a groove in the upper part of the corpora cavernofa, and below in a channel left for the urethra. The internal ftructure of the corpora cavernofa is fimilar to the cancelli of the bones, and confifts of loofe reticular plates freely communicating with each other. Over the cavernous cells the arteries are freely difperfed, and open into them fo as fully to fill them when diftended, and to tinge them in the relaxed ftate. The junction between the corpora cavernofa is made by a continuation of their elaftic covering, which forms a fort of partition, and this partition is compofed of cords that run in a parallel direction from the upper part of the penis to the urethra. Between thefe cords fiffures are left for the paffage of the blood without obftruction.

CCCCXLIV.

The fpongy body of the urethra lies under the

corpora cavernofa, and projects beyond them.   It
begins beyond the union of the corpora cavernofa,
and terminates at the extremity of the glans.
Its external covering, though the fame, is more
delicate than that of the corpora cavernofa.   The
pofterior part of it, fituated within the fkin of the
peritonæum, and extending from the root of the
penis to near the anus, is dilated into a longi-
tudinal prominence of a conical form, termed
the bulb of the urethra, divided anteriorly by a
feptum.

CCCCXLV.

The glans, or termination of the fpongy body
of the urethra, anteriorly is feparated from the
corpora cavernofa by a continuation of their liga-
mentous fheath, and is encircled by a prominent
margin pofteriorly, termed the corona glandis,
behind which is the neck.   The furface of the
glans confifts of a venous plexus, and nerves con-
tinued in a fine membrane from the infide of
the prepuce, which give it fenfibility.   The cervix
and corona of the glans is befet with febaceous
follicles or glandulæ odoriferæ.   The internal
ftructure of thefe parts refembles that of the cor-
pora.

CCCCXLVI.

The urethra, the next part, is a long canal, in
diameter the fize of a writing quill, terminating
by a longitudinal orifice at the point of the penis,

after running from the under and forepart of the
bladder through the corpus fpongiofum.   It de-
fcends fomewhat at its origin, and then paffes
under the fymphyfis, to which it is clofely attach-
ed by cellular fubftance.   Three dilatations of it
are commonly obferved in the courfe of the penis :
one at the proftate, the fecond in the bulb, and
the third at the commencement of the glans.
Thefe are equalled by the fame number of con-
tractions, and this irregular ftructure, along with
its particular ufes, renders it fo liable to difeafe.
Between the point of the proftate and part where
the urethra penetrates the corpus fpongiofum about
a finger's breadth, the ftructure is chiefly mem-
branous, covered only by cellular fubftance.   At
the upper fide the urethra becomes inclofed in
the corpus fpongiofum, which continues to its
termination.

CCCCXLVII.

The lining of the urethra internally is highly
vafcular and nervous, with fome flight power of
contraction.   Between the corpus fpongiofum and
this membrane, efpecially towards the feptum,
numerous lacunae, of different fizes, are placed ;
fome of which, near the glands, are very large.
They obferve a longitudinal direction from be-
hind forward, and perforate the urethra by fmall
orifices, difcharging a thick mucus to defend it
from irritation.

CCCCXLVIII.

Befides the lacunæ between the bulb and pro-
ftate gland, two fmall bodies, covered by the
accelerator mufcles, are frequently met with,
having ducts into the urethra, and ferving the
fame purpofe with the lacunæ, named Cowper's
glands.

CCCCXLIX.

Having examined the ftructure of the male
organs, the ufe of the feveral parts naturally
comes into detail, and chiefly the veffels and the
ducts of the feminal organs.   The firft thing
that ftrikes us, is the fituation of the teftes, ori-
ginally within the body, and the length of the
fpermatic artery running fo far before it termi-
nates on the tefticles.   Some, of late, would per-
fuade us, that there is nothing fingular in the
length of the fpermatic artery, that it takes its
rife from the place neareft to the tefticle of the
foetus, and is afterwards drawn out from neceffi-
fity.   Now this notion is to be rejected; for
fpermatic artery of a ram fhews the fame ft
ture, and difplays alfo vaft numbers of convolu-
tions which it makes in its defcent to the tefticle.
By a calculation, if it was drawn out to a ftr---
line, it would meafure about 20 feet.   An
find that this artery is larger at the tefticle t
at its origin, notwithstanding that it gives off a
number of branches.   This arrangement cannot

be supposed to be made in vain; we must conceive that a change is made necessary for the preparation of the semen, that the length of the artery is of use in a manner that we cannot pretend to specify. From this view in other animals, we are tempted to draw a similar conclusion with regard to it in man, where we would have expected to find it taking its course in half way between its original place in the abdomen and its after place in the scrotum, *i. e.* about the bottom of the iliaca communis. So that some change is made on the blood in its descent depending upon the unusual length of the artery, and therefore we may admit a name applied by the ancients chiefly to the veins, calling them *vena prӕparantes*: we may conceive that the artery does prepare, or begin to make changes fit for the separation of the semen, before it reaches the gland.

CCCCL.

In next examining the vein, it bears an uncommon proportion to the artery. Perhaps some further use is to be derived from the numerous large veins favouring the return of the blood to the heart; and we observe from experience, that that vein is more apt to grow varicose than almost any other in the body. In some persons it is swelled to such a bulk as to stretch the skin of the scrotum; so it may be mistaken for a rupture, or other complaints; but if we apply the hand to

the ſcrotum, the ſwelling is unequal, and it gives
a feel different from that of a hernial ſac, or one
filled with water.

CCCCLI.

We diſtinguiſh a number of chords, and all of
them ſoft, and we find the ſwelling running the
whole length of the chord ; and, in the horizontal
poſition, it in a great meaſure ſubſides ; and
raiſing the body, the ſwelling gradually increaſes,
and the blood enters the vein from beneath up-
wards. Tracing the minute branches, we find
them entangled together ; ſo they were thought
uncommon anaſtomoſes, but the injeꝗions keep
their courſe ; and we can give a general rednefs
to the duꝗs within the teſticle, and we find
conſiderable arteries dividing minutely upon the
ſeminal duꝗs.

CCCCLII.

With regard to the ſeminal duꝗs, the bulk of
the teſticle is very much owing to a number of
threads convoluted, which, from injeꝗion, we
find to be hollow tubes. Meaſuring the ſize of
theſe tubes, and examining the general bulk of
the teſticle, we find, that if the whole teſticle were
ſuppoſed to be formed of ſuch tubes, the length
would be nearly equal to 50,000 feet, or near
to a mile in length. Now we cannot accurately
determine how much of the real bulk depends
upon the red blood circulating in the veſſels, but

it is evident that much more than the one half of
the bulk is owing to the seminal ducts, and the
length of these is not less than 3000 feet in each
testicle.

CCCCLIII.

The next point is the number of ducts enter-
ing into the composition of the testicle, which is
not so very difficult to be determined as might
be imagined; because in the testicle there is a
structure that is altogether singular   We find a
number of small ducts joining into larger ones in
other glands, and therefore the duct continually
increasing; but here the ducts run parallel to
each other, without any anastomoses, or any divi-
sion, or any gland or knot from which they are
derived; so we need only attend to that end
which communicates with the epididimis, and
we can reckon 150 different ducts; and sup-
posing that the mercury has not filled more than
the half, there are 300 such tubes composing each
of the testicles, so that each may be about 10 feet
in length. These are every where convoluted in
such a manner, that we trace the course with dif-
ficulty; and the blood vessels divide upon the
surface, and perform the secretion in a particular
manner. A coloured matter is even seen to pass
from the artery into the tubes, though we fill
them with the utmost difficulty.

CCCCLIV.

Now each of the tubes may b' scarce the two hundredth part of an inch when filled with mercury, which increases their diameter nearly double; and we can trace the course of these ducts the whole way to the vesiculæ seminales. The divisio.. of these convoluted and serpentine tubes is not merely formed by blood vessels, but there are thin layers of the tunica propria, or albuginea, which slide in between, dividing one bundle from another, though not in a regular manner, as an orange is divided by septula. When these tubes run to the upper and back part of the testicle, they become straight; we find vasa recta that come out of them, and there they communicate; or there is a rete testis, or the several ducts of the testicle that communicate just within the tunica albuginea adhering to it; and we find a number of vasa recta coming out, and conveying the semen into the epidydimis, so called vasa efferentia, the number from twelve to fifteen or eighteen. After running a little way, they become convoluted. Now these coni vasculosi run also from the beginning of the epidydimis, and after some time they all unite into a single tube; for, upon fixing a tube with mercury into the vas deferens, and cutting the epidydimis transversely beyond the middle, the injection runs out from one orifice only ; and upon separating the coni vasculosi, they

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all unite into one duct. This at first is not larger than a single hair from a horse's tail, but gradually becomes wider, as we come near to the vas deferens; and it describes 20 feet at least before it terminates in the vas deferens.

CCCCLV.

Thus after the semen is separated from the arteries, it acquires its properties in a great measure by stagnation and absorption, in passing through the seminal tubes; and we observe an uncommon number of lymphatic vessels arising from the testicle.

CCCCLVI.

One would be surprised to conceive by what power the semen can describe so long and intricate a course; and we must suppose that these tubes possess a truly muscular or living power. We cannot observe the contractions, or see the fibres; but the reason of the thing, and the observation that passions have been found to occasion swellings in the seminal ducts, lead to this supposition. In the dog kind the copulation is tedious, because the vesiculæ seminales are wanting; so the semen is brought round in that time from the testicle, and it must pass quicker than at other times, and there must be a living power to convey it, the vis a tergo assisting in some measure.

CCCCLVII.

By attending to the situation of the epidydimis,

we diftinguifh a fwelling in the ducts from one in the tefticle or *chord*. The principal part of the *chord* enters upon the inner fi'c, and the epidydimis is longer than the tefticle, fo that the bottom of it can be diftinctly felt. We likewife fee that the flighteft wound of the epidydimis beyond its middle may interrupt the courfe of the femen, fo that a furgeon ought to be cautious not to puncture it in the fmalleft degree. Even if any fwelling forms that can prefs upon a fingle turn of the duct, the whole organ above will be affected; and if it begins at the lower end of the epidydimis, unlefs it is fpeedily removed, the whole epidydimis and tefticle will be affected. But confiderable fwellings often remain at the beginning of it, in the coni vafculofi, without affecting the tefticle; becaufe, from the communication at the rete teftis, it paffes into the coni vafculofi.

CCCCLVIII.

The vas deferens runs down at the back of the bladder, then ends in the veficula feminales, in this manner: fuppofe the inteftinum caecum, the part of it preffed againft each other, and that the vas deferens coming down againft it, approaches nearer to the veficulæ feminales, and is more convoluted; and add to the inteftinum caecum a number of inteftinula caeca, feveral facs containing the femen, and add the fame to the vas deferens, the furface is greatly increafed, with a

view according to the qualities of the semen.
Perhaps the proſtate gland mixes its liquors with
the ſemen within the penis; but that is not ſo
eſſential as the liquor in the teſtes; for in ſome
claſſes of animals, as in birds, it is wanting, yet
the ſtructure of the teſticle is the ſame as in man,
ſo it is only of ſecondary uſe. There is a quantity
of mucus diſcharged for a defence againſt the
urine.

CCCCLIX.

o   I ug tit t ms   th or ction
n   o e h   n w !   t depends
r o an unuſed ſlow of blood   ade from the
arteries, by their oſcillations being increaſed.
The common opinion is, that it depends upon a
diffi ult return of the blood through the veins;
and if the veins are tied up, the penis is in a cer-
tain degree diſtended.

CCCCLX.

The only difficulty is to determine the means
by which the ſtoppage is made, for that has been
improperly explained, viz. that the vena ipſius
penis runs on the pelvis, and that the muſcles
preſs it; but they rather draw down the penis,
and make a preſſure againſt the corpora cavernoſa.
The vena penis poſſeſſes a muſcular, or contrac-
tile power, for it is redder and thicker than the
other veins; and the principal plexus paſſes away
from the artery in a very unuſual manner within

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the levatores ani, and is expofed to the action of thefe mufcles, which are in action at the time, and fome degree of contraction in the coats of the veficulæ feminales may affift in emptying them.   The weight merely of the urine may dif-pofe to the erection of the penis, and the blood being effufed into the cells caufes the diftention.

CCCCLXI.

Female Parts of Generation.

The female parts of generation have commonly received, from anatomifts, a divifion into external and internal, or thofe which appear to view on the mere expofure of the body; and thofe, again, which are mor   l, requ   a fi of parts, and a more minute infpection to detect them. The former comprehends the mons veneris, the labia externa, nymphæ, and clitoris; the latter the vagina, the uterus, and its appendages.

CCCCLXII.

The mons veneris is the rifing eminence we find fituated at the termination of the recti mufcles, or immediately above the next part, the labia externa.   It is compofed of a quantity of adipofe fubftance, which forms the fkin into a kind of tumour; and on this the firft figns of puberty come to be confpicuous. It is through this part alfo, an incifion is directed in thofe cafes where a divifion of the fymphyfis to enlarge the pubis by the operation of Sigault is made.

CCCCLXIII.

From its inferior part, on each side, arife the labia pudendi. In their texture, they refemble the mons veneris; and in their appearance a great variety prevail in different fubjeéts. In fome they are large and protuberant; in others, again, they are fhort and flaccid. Before parturition, however, they are generally fhorter and more confined than afterwards, for they become length-ened by repeated labours; and in fome cafes alfo their fatty part decreafing, they become harder, and lofe their fenfibility. Their extent is moftly from the fymphyfis of the pubes to near the anus, a fmall fpace only termed the perinæum, or four-chette, intervening to form a divifion; yet, in particular cafes, they have been found to extend to the anus itfelf. Internally, the membrane which lines them feems more condenfed than the external, and is furnifhed with a number of fmall glands which excrete a febaceous liquor for moiftening their furface. By their foftnefs they give no refiftance to the paffage of the child when fo far advanced during labour; and, at the fame time, they form a fufficient covering, by their junétion, for defending from external injury the parts below.

CCCCLXIV.

On feparating the labia appear two fmall flefhy bodies of a fimilar figure. They are termed the

nymphæ, and confift of a doubling of the internal membrane which lines the labia and the interior parts. They differ in their appearance in different women, and are of a texture very vafcular, efpecially in their inner furface. Befides the purpofes they ferve in coition, their chief ufe feems to be to direct the flow of the urine, for they poffefs a mufcular contraction at each time of its emiffion; though this is ftill more remarkable in fome animals, as mares, in which alfo the labia have in fome degree the fame power. In girls, they difcover fomewhat of a corrugated appearance, and are very fmall; but after the age of puberty, or on the application of any ftimulus to increafe an afflux of their circulation, their fize becomes enlarged. Hence they are fuller and more protuberant in proftitutes, and lefs fo in modeft women. This enlargement is fometimes preternatural, efpecially in hot climates, where an operation for their explanation, named nymphotomy, is therefore required.

CCCCLXV.

Immediately above the nymphæ, the latter being fomewhat connected to its inferior part, is obfervable a fmall glandular fubftance. It confifts chiefly of a congeries of veffels, covered by a loofe fkin, received from the internal membrane of the labia, termed its preputium; and this vafcular part, or proper body of the clitoris,

takes its origin from the inferior part of the or a
pubis, by means of two crura which unite here
to form it. It has commonly been compared
the penis of the male, and in some respects, per-
haps, resembles it. For, as it receives a more
than usual quantity of blood above the parts de-
scribed, it possesses also a greater degree of tur-
gescence; and, from its sensibility, as its increase
of fluid is easily produced by the application of
any stimulus, it has become in consequence of
the latter, and by the dilatation of its vessels,
frequently elongated to such a degree as to shew
a similar erection. It differs, however, from the
male penis in some particular circumstances, for
it has no aperture or perforation for the trans-
mission of any fluid, and consequently no corpora
spongiosa, and it is tied down likewise by a kind
of suspensory ligament, as has been apparent in
those who have been shewn for hermophradites.

CCCCLXVI.

Between the nymphæ there appears on their
separation a hollow space, named the fossa navicu-
laris, in the middle of which is observable a small
prominence, or granulated point, being the ori-
fice of the urinary passage, or urethra, in the
female. It is larger than that in the male, and
admits in diameter the size of a quill. Its whole
length measures only about 1½ inch from the
bladder, which possesses at its neck no prostate

...ted, and forms the less resistance by this state of ... its parts to the passage of ...deali. By the pro-... ...nence observed in its ... ..., the urethra is ...ily distinguished b. ...ts feel; and ...d it there ...lso situated a number of mucous glands, which ...rete a liquor for defending the parts from the ...fluence of the urinary acrimony, and these, as ...nes, being attack... ...y inflammation, acquire ...ch a patulous state, ...s to equal in diameter the ...e of the urethra itself; for which they are even ...metimes in such instances mistaken.

CCCCLXVII.

About two inches or less below the urethra, ...t described, by which its orifice is sometimes ...ncealed in women who have born children, on ...parating the labia appears the first of the internal ...arts, or the mouth of a large hollow ..., termed ...e vagina, which opening is called the os externum. ...t forms the entrance to the more interior parts, ...nd is the passage through which the foetus is transmitted in delivery. Anteriorly, it is connected to the bladder, which is somewhat larger in the female, and more rounded in its shape than in the male; and posteriorly, to the rectum. Hence injuries happening here are continued through these organs, and a passage for the urine and faeces has thus frequently taken place for life from this situation. It consists of three coats. 1. A. mus-cular, by means of which its fibres possess the

power of contraction, and therefore its dimensions
vary at different times; and so strong is this muf-
cular power which the vagina poffeffes, as fre-
quently to throw inftruments from their place
when introduced for the purpofe of delivery. 2*dly*,
A rugous; and 3*dly*, an intermediate quantity of
cellular fubftance. In its appearance, it is fome-
thing fimilar to the membrane of the palate; for
before parturition, or in young girls, it poffeffes
on its internal furface a number of corrugated or
wrinkled folds, termed its rugæ, which are placed
in a tranfverfe direction, in the form of an arch,
fo as to allow a greater enlargement of its dia-
meter when expanded by the preffure of the fœtal
head in its expulfion to delivery. It is on this
account, alfo, we find them moft numerous on its
anterior fide, where it lies towards the urethra,
and where the greateft degree of extenfion for the
enlargement of its limits is required. Its length
varies at different periods, and in the unimpreg-
nated ftate it is generally three inches, though it
depends for this on the fituation of the uterus.
After conception, the uterus falling lower, it be-
comes fhorter. As the uterus, however, ftretches
upwards, it proportionally lengthens out the va-
gina; and, as its orifice projects loofely into its
cavity, whatever caufe relaxes the vagina, occafions
its falling lower. The fame variety prevails alfo
in its width. At the age of puberty it is ufually

so straight as hardly to admit a finger; and in the first coition, therefore, the introduction of the penis becomes difficult. When conception in such circumstances takes place, labor is on this account tedious and difficult, and a long time is necessary for the stretching of the parts. After child-bearing, however, its dilatation becomes so great, as easily to admit the whole hand; though, even in this state, from its contractile nature it can accommodate itself to the size of any exciting body introduced within its cavity. The degree of this contractility has been supposed by some to depend on its distance from the period of menstruation, by which the whole of the genital system is relaxed, and particularly the passages.

CCCCI.XVIII.

In its diameter, the vagina differs at different places; for at its two extremities it is more contracted than in the middle. The os externum we find surrounded with a muscle whose fibres run in a circular direction, and serve, by this means, when excited into action, strongly to contract it. They take their rise from the ossa pubis, under the situation of the clitoris; and, by this muscle, in those women who are advanced in life before the occurrence of pregnancy, a resistance to the passage of the head for the space of some hours is formed. In youth, also, in the first labour it becomes spasmodically constricted, and possesses

the fame effect. On the internal furface of the vagina, befides the rugæ mentioned, we obferve every where a number of fmall glands of the fame nature with thofe round the orifice of the urethra, formerly defcribed. They excrete a mucus moft confpicuous in the time of coition and during labour, by which the effects of the ftimulus attending both thefe operations is obviated, and the hazard of inflammation avoided. Its too copious difcharge occurs alfo at times, and forms then a difeafe.

CCCCLXIX.

But, befides the mufcle ferving to contract the os externum, and which is not fo confpicuous, requiring a pretty accurate diffection, four fmall glandular bodies are obfervable of a fimilunar fhape, though fomewhat different with refpect to their particular figure: in different objects they are generally very regular in their appearance, termed the caruncula myrtiformes. Many difputes have prevailed among authors with regard to their nature and ufes. They feem partly much of the fame kind with the nymphæ, being certain rugofities of the fkin to allow the ftretching of the parts when required. Though pretty diftinct in the only part of life before parturition, they generally difappear like the rugæ of the vagina after childbed, which further confirms our opinion of their ufe. Many, however, have fuppofed their ftruc-

ture glandular; and, if fo, the particular offices
they may ferve by their excretion we are ftill at
a lofs to determine.

CCCCLXX.

Inftead of them, or as fome affirm, previous to
their appearance in the infantine ftate, we find a
thin membrane in the form of a crefcent extended
partly over the orifice of the vagina, named the
hymen. No fubject has, perhaps, been more dif-
puted by anatomifts than the exiftence of this
part, and we have the authority of the late Dr.
Hunter for declaring that it is never abfent in a
female at birth. From its texture, however, it is
eafily ruptured by accidental caufes in childhood,
and then affumes the appearance of the carunculæ
myrtiformes. In fome cafes it has been known to,
continue, however, entire to the age of puberty,
and to extend further over the os externum than
ufual. In fuch cafes an incifion has been found
neceffary for its removal.

CCCCLXXI.

The parts of the genital fyftem, as yet examined,
may be confidered only with regard to generation
in a fecondary view; and we are next, therefore,
in our examination directed to thofe organs which
are more interiorly fituated, and with which gene-
ration itfelf is more immediately connected.

CCCCLXXII.

The firft of thefe, at the extremity of the

vagina, is the uterus. It is fituated in the middle
of the pelvis, between the bladder on its anterior
part, and the rectum posteriorly; and hence, in
confequence of difeafe, a communication with
both thefe, as in the cafe of the vagina before
mentioned, may be occafionally produced. In its
natural ftate its figure has been compared to a
pear flattened on its fides, or to a fmall powder
flafk; and by this flatnefs on its fides, which is
moft remarkable pofteriorly, where it joins the
rectum, it comes to be more clofely retained in
its fituation, or applied to the neighbouring parts.
Anatomifts have commonly defcribed it under
three divifions, or diftinct parts; the fuperior and
largeft one bounded by the Fallopian tubes, being
termed its fundus; next to this its body, and its
inferior portion ending in its orifice, named the
cervix or collum. At both its extremities the
uterus is a little convex, and at its fundus this
convexity is increafed in the pregnant ftate, by
which, when diftended, and rifing above the pel-
vis, as we fhall afterwards find, it forms fome-
thing of an arch, and becomes more capable of
fupporting the incumbent vifcera. Its fize has
been commonly fuppofed to meafure longitudi-
nally, beginning from its fundus to its orifice,
three inches; and tranfverfely, from two to one,
according to the diftance at which we take it
from the fundus. After the age of 14, or the

appearance of the menfes, it does not feem to increafe, and in this it differs from the other organs of the body. Some fmall difference, however, may be perceived at each fucceffive period of this difcharge, for before the evacuation, the fundus may fometimes be felt in thin women by the hand applied on the abdomen, tenfe and more than ufually diftended ; and thofe alfo, who are fubject to profufe menftruation, from the greater dilitation of its veffels, have the uterus confiderably more enlarged than the others. Some authors deny that the uterus, internally, before impregnation poffeffes any fenfible cavity. It is, indeed, fmall, but when cut open, will be found very apparent. Its figure is triangular, two angles of which arife from the orifices of the Fallopian tubes, and the third from the os tincæ. Through its whole fubftance the uterus feems, on diffection, to poffefs a very compact nature, which has been compared, from the whitenefs of its texture in the virgin ftate, to the corpora fpongiofa penis. Externally, it receives a covering from the peritonæum, and this covering forms the means by which it is connected to the Fallopian tubes and ovaria, while internally, again, the fine membrane lining the vagina, is continued over its furface, and hence it poffeffes here the fame glandular texture with that of the vagina defcribed. Before pregnancy, it is even diftin-

guished by the same rugous appearance; and these rugæ are most numerous at its neck, where, after parturition, some traces of them in young subjects still remain. In the neck, also, are conspicuous a number of small lacunæ, or ducts, which pour out a mucus for lubricating the adjacent parts of its cavity, and which forms a cement, closing the orifice of the uterus during gestation. From our experience of its contractile power in labour, by the expulsion of the child we are naturally led to suppose the uterus a muscular organ. Its muscular fibres, however, till after delivery, it is difficult to distinguish, and then they appear to be matted together irregularly, so that there is no proper foundation for the musculus orbicularis painted by Ruysch. These muscular fibres, when perceptible, are most so on its external surface, which is less firm than the internal, and the latter again than the cervix. In proportion to its size, the uterus receives a greater quantity of blood than any other organ, the heart and lungs excepted, and its vessels are therefore, even in the natural state, proportionally large. They are derived from the hypogastrics and spermatics, those from the latter being smallest, and are spread in a tortuous convoluted manner through its substance. The veins, however, are still larger than the arteries, and are derived also from the same source. They have no valves, and by this means

the motion of their fluids is rendered flower,
and a degree of ftagnation favoured, while fre-
quently anaftomofing in particular places, they
acquire in this way a remarkable fize, and are
therefore diftinguifhed in pregnancy by the name
of finufes.

CCCCLXXIII.

The nerves of the uterus are derived from
branches of the 6th pair, or that one which fup-
plies the ftomach and fome of the other vifcera.
It receives them likewife from thofe of the facrum,
and hence the remarkable fympathy, in cafes of
difeafe, it communicates to all thefe parts. The
fituation of the uterus, we mentioned as in the
middle of the pelvis, above which it is not to
be felt in the unimpregnated ftate; for a line
drawn from the top of the facrum to the pelvis,
will hardly fall within its fundus: but before the
age of puberty it is generally found higher,
being, in confequence of the preffure of the in-
teftines and its attachment with the bladder of
urine, made gradually to fink lower; and after
conception it comes again to be raifed, to as, at
the end of geftation, to reach as high as the pit
of the ftomach. It is not placed perpendicularly,
but a little to one fide, and that commonly the
left, which we find very apparent in pregnancy.
The neck of the uterus projects, as we obferved,
into the vagina, and that in young fubjects, in

the form of a nipple or small tubercle. After par-
turition it becomes in its figure more eliptic;
and in those who have born many children, the
finger may be introduced within its orifice for a
little way. We find a vast difference between the
structure of the uterus in animals, when com-
pared with that of the human subject. In them
it is separated into certain divisions, or cells, for
the reception of each fœtus, not possessing a uni-
form cavity like that described, and these cells
have not the smallest connection. Its internal
substance is likewise unequal at particular places,
by certain glandular bodies growing from its sub-
stance, named cottilydons, and which serve, by
being connected with the fœtus, to nourish it in
the pregnant state. The uterus is preserved in its
situation by four ligamentous expansions, or pro-
ductions from its external covering. The first are
named the ligamenta lata, and are connected to
the bones of the ilium, so as to retain it in its
proper length; and the latter, running off from
the former in the form of cylindrical chords,
from their figure are named the rotunda, and pass
through the groin, in the same place as the sper-
matics in men, confining it before. Both are
lessened in their size by their extension during
pregnancy, and especially the round ones. Their
situation is also somewhat altered, during the
same period; for, by the enlargement of the

fundus, the broad ones are placed in a situation much below the middle of the uterus, which they formerly possessed; while the uterus itself is less fixed, the greater part of its body floating loose in the abdomen; and an inversion of it, on this account, is more readily endangered after delivery. The round ones have, by many, been supposed to act in a certain degree as muscles to the uterus, by drawing the fundus a little downwards, and consequently lowering its orifice for the more easy admission of the semen in coition, and the descent of the child's head in labour. In the latter case, it seems to prevail in a first labour, when the fundus rises higher than afterwards, and where, of course, they are put more upon the stretch. The ligamenta lata have no remarkable circumstances to distinguish them, except from forming also a covering to the Fallopian tubes and ovaria. Where that part of the uterus, named its fundus, ends, are observable two small orifices, fit only to receive the size of a hog's bristle, and which enlarge in width, in the manner of a trumpet, as the cavity of their passage ascends, terminating at last in a sort of ragged or fringed appearance, which is loose and floating, named the morsus diaboli, and is somewhat similar in its figure to the foot of a frog when expanded. These passages are termed, from the name of their discoverer, the Fallopian tubes; and merit our

particular attention, as on their ftate, along with that of the ovaria, the occurrence of conception has been fuppofed to depend. Their cavity proceeds not in a ftraight, but convoluted direction, meafuring near three inches in length, and their texture feems evidently of a mufcular nature, though its fibres, from their minutenefs, it is difficult to unravel. They are connected to the ovaria, or two oblong bodies, by means of their covering or external coat, and in this connection they fhow fome refemblance to that of the inteftines with the mefentery.

CCCCLXXIV.

The ovaria are two oblong foft bodies, fituated befide the Fallopian tubes, and fo named by phyfiologifts from their containing, on diffection, a number of fmall veficles, or limpid bags. They have been commonly compared in their appearance to the tefticles, and fuppofed as defigned for a fimilar function, and hence is derived the opinion of the femen in the female. Their figure is fomewhat different in different women. In their fize, however, they are pretty much the fame, though after childbearing they turn more flaccid and decayed; and their ftate has been fuppofed in a great meafure to influence the other parts of the genital fyftem. Their dimenfions are commonly rated at 1 inch in length, ½ in breadth, ¼ in thicknefs, and their texture feems very vafcular, while their fur-

face externally is very unequal. The number of ova contained in them is very various. These ova form the rudiments of the future foetus, an opinion fully established by the experiments of many modern physiologists.

CCCCLXXV.

In reviewing the genital parts of the female, we observe no holes naturally leading out from the ovarium, and yet afterwards it will appear, beyond all doubt, that the ova discharge themselves upon the surface; for the chord which ties the ovarium to the uterus is solid, and is not, as was supposed, a tube serving for conveyance; it is merely a ligament; and the only passage we find between the ovarium and uterus, is through the tube named uterine, or, after its inventor, Fallopian. The mouth of this is wide, more than sufficient to contain an entire vesicle from the ovarium; but then, as it approaches the uterus, it becomes much smaller, only admitting a large bristle. Around the mouth, which opens into the cavity of the pelvis, or abdomen, we find a number of fimbriæ, or fringes; and although these serve one uniform purpose of laying hold of the ovarium, as we lay hold of any substance by the hand, yet it is found that the fimbriæ vary in their shape in every subject. Their structure, and that of the rest of the tube, is, without all doubt, muscular; we distinguish red fibres, that are laid

parallel to one another, we have the same evidence
of muscular structure here that we can give in
describing the parts of the alimentary canal. The
uterine tube terminates at the corner of the uterus,
serving to convey the rudiments of the fœtus into
it. We avoid determining the appearance of the
rudiments more exactly; nor do we say that one
entire ovum passes, but merely a somewhat is
conveyed.

CCCCLXXVI.

The uterus is spongy in its inner part, and is
full of vessels with orifices, from which blood is
discharged into the cavity of the uterus at every
menstrual period. The cavity of the uterus be-
comes gradually of a roundish shape, and forms
the cervix uteri, and this part we have seen un-
equal, with a number of rugæ or valves, and in
these interstices a quantity of slime is deposited,
and the texture is different from the rest of the
body of the uterus. The end of the cervix uteri,
or os tincæ, is directed backwards, and rests against
the vagina, and it is kept in this situation by the
manner in which the uterus and its appendices
is supported by the ligamenta lata, which are
doublings of the peritonæum, the same as the
mesentery is. To shew the advantage of this
situation, it may be remarked, that the ligamen-
tum latum, by the distension of the uterus, is
gradually lessened in its breadth, till in the last

months of pregnancy we fcarcely can fhow it ; fo
that it does not merely fupport the uterus in the
unimpregnated ftate, but is fo formed, that
the outer covering may yield in proportion to its
growth, and the lamellæ are gradually feparated
fiom each other to keep the uterus more fteadily
in its place. We alfo find the ligamenta rotunda,
which ferve to balance the uterus, to keep it from
being tofled from fide to fide, and they alfo drag
the body of the uterus forwards, and therefore
ferve to keep the os tincæ more in the direction
backwards, and thus the uterus is turned more
backwards in the time of pregnancy than it is at
other times, when there is more occafion for pre-
venting its falling down into the vagina. The
vagina in prefling downwards, is likewife not a
ftraight direction, but refembling the inteftinum
rectum, at the lower part turns forwards, and
that ftill in a greater degree. Within the vagina
we find organs for fecreting mucus, and at the
external part, cells that are capable of diftenfion,
containing the corpora cavernofa. On the manner
of their diftenfion it may be faid that the external
parts, by their fenfibility, ferve to excite thefe mo-
tions of the internal, which are necefſary for con-
ception, particularly of the uterine tubes towards
the ovaria, and afterwards in promoting the fome-
what into the cavity of the uterus. From attend-
ing to the connection and fituation of thefe parts,

we can underſtand ſeveral things that happen in
practice.

CCCCLXXVII.

First, without entering into the reaſon of it,
it is a fact that neighbouring parts ſympathize
or ſuffer together. Thus, if the middle finger
has been bruiſed, and inflames, the one next it
more readily partakes of the inflammation than a
more diſtant part. So in practice we find that an
irritation being applied to the bladder, uterus, or
rectum, the affection is propagated from the one
to the other. Thus the menſtrual flux can be
retarded by an irritation begun in the bladder
or rectum, and the bladder will ſympathize, and
a ſtrangury be occaſioned by an affection of the
uterus or vagina. We can alſo conceive that the
mechanical connection of the parts muſt have
a very conſiderable effect, for the bottom of the
bladder is connected cloſely to the vagina, not
only the urethra being connected, but likewiſe the
body of the bladder, and that higher than the
mouth of the urethra, and we may make an appli-
cation of this in ſeveral caſes. Thus, if there
ſhould be a prolapſus uteri into the vagina, it
muſt neceſſarily drag along with it the under and
back part of the bladder, and likewiſe affect the
inteſtinum rectum, though there is here a leſs
connection, from mere cellular ſubſtance being
interpoſed. Remarkable caſes have occurred where

the prolapsus uteri has been to such a degree,
that the uterus has fallen without the body, the
os tincæ forming the lowermost part of a tumour
reaching between the thighs, and the back of the
bladder has been dragged along with it, so as to
invert the urethra, so that the urine has had to
ascend in order to get out, and the bladder been
so much distended, that it reached higher than
the umbilicus, and was capable of containing six or
eight parts of liquor, with which the coats were much
thickened. The bladder may be supposed to affect
the uterus; so, if a stone in the bladder proves
an irritation as frequently to cause the prolapsus
ani, which is by no means uncommon, it may
have a similar effect upon the uterus and vagina.

CCCCLXXVIII.

The mere distension of the parts here preserving
their natural place must have a very considerable
effect, hence it is a rule laid down by writers in
midwifery to empty the bladder and rectum before
delivery. And we can explain why in one stage
of pregnancy a woman will not be able to retain
the usual quantity of water, from the uterus press-
ing upon the bladder : but in another situation the
weight of the uterus bearing down upon the
urethra, and compressing it against the os pubis,
there may be a necessity for drawing off the water
with a catheter, or a costiveness may be induced
from the same cause. We also see the danger

there may be of fistulæ forming between the
bladder and vagina in consequence of a violent
inflammation from a laborious delivery, &c. Many
examples occur where the urine has made its way
through at the cervix of the bladder into the
vagina, and it is found impracticable to cure the
patients by any operation. From other causes, as
in cancerous cases, we find also erosions and com-
munications between the vagina and intestinum
rectum.

CCCCLXXIX.

If there were a necessity for making a large
opening into the cavity of the uterus for extract-
ing a child, the danger of that would be consider-
able, from the whole body of the uterus being
covered with the peritonæum. If water were col-
lected in order to avoid this circumstance, we
would attempt to make the discharge by making a
puncture through the cervix uteri. The ovaria
are frequently the seat of dropsical complaints,
and the water is no doubt contained in the
natural ova, which are sometimes considerably
enlarged to the bulk of an egg; and if these are
small and moveable, we cannot let out the water
without the most manifest danger, and we can
only attempt it when, by pushing against the
adjoining parts, they excite inflammation and
function.

CCCCLXXX.

Next, is feen the ureter going into the bladder between it and the vagina; and it is of ufe to attend to this, for cafes have occurred, where a ftone has defcended as far as the bladder from the kidney, but flicking in the ureter, ftopped the flow of the urine, and killed the patient. Now, if we can judge this to be the complaint, we may feel with the finger, and we will be able to perceive the ftone through the coat of the ureter; and, perhaps, by the finger or an inftrument, we may get it back into the bladder; or, it is poffible to make an incifion without any danger, but the opening remaining fiftulous into the vagina, and this might not even commence. Or, if a ftone lies within the body of the bladder, we can not only perform the fame operation with more fafety than in the cafe of the bladder moderately filled .... good way .... capacity of .... vagina into the bladder .... fiftula, or .... bladder has .... ulceration, making

way into the vagina.   If, in the male, we prefer
the lateral operation to any other, there is further
reafon for preferring it here, where there is want-
ing the proftate glands and veficulæ feminales.
Likewife we can, as in the male, make the
puncture into the bladder between the crus of
clitoris, or fide of the vagina; or it may be done
directly from the vagina, paffing an inftrument at
pleafure near to, or further from, the neck of the
bladder.

CCCCLXXXI.

The defcription of the gravid uterus, and the
changes induced by conception, are detailed in
the Clinical Guide, Vol. III. Midwifery.

CCCCLXXXII.

*Chemical Analyfis of the Secretion of the Parts of
Generation.*

The mucus of the urethra differs in no refpect from
the mucus elfewhere, and under irritation it is increafed
in quantity, and changed in confiftence in a confiderable
degree.

The fecretion of the glans penis is of a febaceous
confiftence, and it poffeffes a peculiar odor, the organ of
it being lined by fome odoriferous glands; and, like the
other fecretions, it is confiderably increafed under irri-
tation, and when a neceffity exifts for its ufe.

The tunica vaginalis of the vesticle poffeffes an aque-
ous exhalation to admit the free motion of the organs,
which is often confiderably increafed under difeafe.

The proftate gland fecretes a lactefcent juice, which being emitted always along with the femen, muft be neceffary to the perfection of that fluid.

But the moft important fecretion of thefe parts is the femen, which is alfo the moft highly elaborated of any in the body. In tafte, it is fatuous and aerid. In confiftence, it varies according to the progrefs of its courfe, being thinner in the tefticles, and vifcid, denfe, and pellucid in the veficulæ feminales; but debility and relaxation produce a change in its quality. In colour, alfo, it varies a little in different parts of its progrefs, being of a deeper hue in the veficles than in the tefticles.

Its conftituent principles are ;

1. Water, 90 parts.
2. Animal mucilage, 6 parts.
3. Phofphate of lime, and muriate of foda, each one part.
4. Pure foda, 3 parts.
5. An animalcular appearance ; and,
6. An odorous principle, or aura feminis.

It changes violets green. When frefh, it is infoluble in water, but afterwards combines eafily with it. It is at firft opaque and confiftent, but in a few hours becomes clear and pellucid, and in a few days depofits foliated cryftals of phofphate of lime. Its ufes and importance in the fyftem are well known.

Chemical Analyfis of the Secretions of the Female Parts.

The unctuous fluid of the inner furface of the labia pudendi is of a mucous oily confiftence, of a yellowifh colour, and peculiar offenfive fmell. It confifts of an

oily mucus, mixed with a peculiar odorous principle, which probably ftimulates to venery.

The mucus of the vagina is of a vifcous nature, and moft abundant towards the end of pregnancy, and in parturition.

The excretion of the venereal orgafm is a whitish mucus, fomewhat different from the common fecretion of the vagina. Its quantity is very great in the fallacious.

The uterine fecretion, or ferous difcharge, is in virgins turbid and whitifh, in children always fo, and in pregnant women it is fometimes lactefcent. Its quantity varies at different times.

The mucus of the uterine cervix is very thick during pregnancy, and fometimes of a reddifh colour.

The liquor of the ovarium appears to be albuminous, coagulable by alcohol and fire, and ductile into white threads.

The menftrual and lacteal difcharges differ nothing from common blood, already examined.

Anatomical Preparation of the Penis.

To make an injection, an adult penis is preferred, which fhould be removed from the body for the greater eafe of the procefs. The knife, in doing it, being carried clofe to the pelvis, fo as to avoid wounding the crura, and carried towards the bladder fo as to feparate it by a tranfverfe incifion juft before the proftate. For this purpofe a fection of the fcrotum fhould be made to allow its complete removal. The blood in the corpora cavernofa is then to be wafhed out by firft fixing a middle fized injection pipe in one of the crura through

a small incision purposely made, and then injecting warm water afterwards, poured out and repeated so long as it shews a bloody tinge. The orifice of the large vein on the back of the penis is then to be found in the groove formed by its septum, and a probe introduced into it as far as the glans, in order to break down its valves, which would obstruct the progress of the injection. A pipe is then to be fixed in it, and warm water injected to clear it from grumeous blood, and again prest out. Let it then be prepared for injection by immersing it for an hour in warm water, and the corpora cavernosa are then to be filled with coarse yellow injection, and the vena magna, glans, and spongy body, with red. The teguments being afterwards dissected from it, the preparation is to be dried and varnished, or preserved in spirits of wine.

Anatomical Preparation of the Testicles.

The testicles are to be removed from the body, and the spermatic cord is to be separated as high as possible without wounding it. The artery should be filled with fine and coarse red injection, and the vein with coarse yellow. The vas deferens should be always filled with quicksilver; for, from its length and smallness, it cannot be filled with any other injection, and in doing it considerable time is required from its convolutions. It should remain for some time under water in the injecting tube, that the injection may pass as far as possible by its own weight, and the injection of this part should follow that of the other vessels. The ends of all the vessels are then to be tied, and next the surrounding extraneous substance dissected away. The preparation

is then to be laid in water for some days to extract the blood, and brighten its colour, after which it is to be suspended in the air till the parts dry, and then be preserved in oil of turpentine In making this preparation, all the vessels should be previously well cleared from blood.

Preparation of the Internal Structure of the Penis.

Where the internal structure of the penis is wished to be shewn, its arteries are first to be injected by coarse red, fixing the pipe for this purpose on each side in the internal pudendal artery, on the inner side of the ischium. The penis is then to be removed, and injected as already directed, but with quicksilver entirely. It is then to be macerated in water till the cuticle peels off, and suspended in the air till thoroughly dried. With a knife, two lateral portions are then to be removed from the glans to the crura, which will lay open its internal parts. Two lateral pieces are also to be removed from the glans. These openings giving an exit to the quicksilver, will better shew the internal structure. Immersed in oil of turpentine, the preparation will become transparent, and exhibit the ramifications of the vessels through the corpora cavernosa.

Corroded Preparation of the Penis.

This preparation is injected, as directed in the first. When finished, the part is to be put in the muriatic acid solution till the parts are fully destroyed. When removed from the acid, it is to be washed as other corrosions, and caution used not to break any of the vascular branches.

CCCCLXXXIII.

Circulation of the Pelvis and the Lower Extremity.

Having examined the genital fyftem in both fexes, it remains to trace the circulation and nerves of the pelvis, from thence proceeding to the lower extremities.

CCCCLXXXIV.

The lumbar arteries, four in number, on each fide arife in pairs from the back of the abdominal aorta, and refemble the intercoftals in this refpect as they arife in the thorax. They run over the fore part of the lumbar vertebræ, and, defcending, they give branches to the fpine and fpinal marrow; and, being difperfed upon the lumbar mufcles, they alfo furnifh branches to the teguments. Next, the facral artery, running along the middle of this bone, gives circulation to the bones, membranes, and back part of the rectum.

CCCCLXXXV.

The common iliacs arife from a divifion of the aorta at the 4*th* lumbar vertebra. They are of equal fize, and at the laft vertebra of the loins they each divide into two branches, an anterior and pofterior one, or the external and internal iliac artery.

CCCCLXXXVI.

The external iliac, or continuation of the common trunk, defcends along the brim of the pelvis, takes a curved direction by the fide of the pfoas

muscle, and passing behind Poupart's ligament, goes to form the femoral artery. Within the abdomen it sends off two branches, the epigastric and circumflex of the ilium.

CCCCLXXXVII.

The internal iliac is chiefly distributed on the pelvis, and gives branches to all the parts contained within it, and which branches chiefly take their names from the parts they supply, and are very numerous. Thus they give the chief branches to the bladder and penis, and also to the uterus and genital parts of females.

CCCCLXXXVIII.

The circulation of the lower extremity again begins with the crural or femoral artery, which, about two fingers' breadth below Poupart's ligament, divides, like the common iliac, into an anterior and posterior branch, the former continuing, as the proper femoral artery; the latter, being termed the profunda femoris, which sends off branches to all the adjacent parts in the progress of its descent. The femoral artery again passes between the triceps muscle and the bone, to which it keeps close till it reaches the ham, and is there termed the popliteal artery. Passing between the condyles of the os femoris, it gives off several branches to the joint, and next to the upper part of the leg; then descending, it gives off to the outer edge of the popliteus two large arteries, the

tibialis antica and postica, the former supplying the fore, the latter the posterior part of the leg. These tibial arteries, in their progress, give off numerous branches. At the ankle they send off the principal plantar branches, and these again subdivide into the interosseous and digital arteries. These arteries of the foot freely communicate with each other and form anastomoses, so as to preserve a full and free circulation of these parts.

CCCCLXXXIX.

The veins of the inferior extremity consist of a subcutaneous and deep set. The former consist of two principal trunks, the saphenæ; the latter are more numerous, and correspond to the arteries in their course and names. They all end in the iliacæ communes, which unite to form the inferior cava, which exceeds in size that of the superior, and receives, at its beginning, the sacral and lumbar veins, which in the left side pass behind the trunk of the aorta.

CCCCXC.

Nerves of the Pelvis and the Lower Extremity.

From the nerves formerly described of the chylopoetic viscera, we descend to the hypogastric plexus, which is connected to the great sympathetic and sacral nerves, and sends small twigs to the bladder, rectum, and spermatic vessels in the male; and to the same parts, and the uterus and vagina in the female. The great sympathetic

runs along with the lumbar and facral nerves, and
fupplies the loins, pelvis, and inferior extremity.

CCCCXCI.

In doing this, the fympathetic nerve from the
lumbar vertebræ defcends into the pelvis, and
pafles over the anterior furface of the os facrum.
At the lower part of the pelvis it becomes fmaller,
finilhing its courfe on the coccyx. In the loins
and pelvis it forms ganglia, which, in the latter,
are connected with the facral nerves.

CCCCXCII.

The five lumbar nerves in their defcent form a
plexus, which is fituated behind the pfoas mufcle,
and termed the lumbar plexus. In their farther
progrefs thefe nerves unite, and form a trunk of
great fize, named the crural, which fends down
branches to every part of the leg.

CCCCXCIII.

The facral nerves confift of fmall pofterior, and
large anterior trunks. They go out of the holes
in the forepart of the facrum, and unite with each
other, and with branches of the fympathetic. They
afterwards in part join with fome of the lumbars,
and form a plexus which gives origin to the
fciatic nerve, the largeft in the body. The roots
of the fciatic form the fafciculi, from whence
arifes the pudic nerve. The fciatic nerve, after
leaving the pelvis, defcends in the back part of

the thigh to the ham, where it receives the name of the popliteal nerve, and in this course it gives off a great number of branches. A little above the bending of the knee it is divided into the tibial and fibular nerve, which poffefs alfo their fubdivifions. In the end, the tibial nerve divides into the external and internal plantar of the foot, which are diftributed as the principal fupply of the fole and toes.

CCCCXCIV.

We now come to confider the vafcular diftribution of the inferior extremities in review. The trunk of the aorta within the abdomen is clofe to the fpine, hence the fwelling and ftroke of it are entirely outwards; fo that in many perfons the containing parts of the abdomen being preffed backwards, we can diftinguifh the ftroke; and fometimes perfons have been fuppofed to labour under aneurifm of the aorta from this circumftance.

CCCCXCV.

About the fourth lumbar vertebra the aorta divides into two equal branches, for there is nothing found in the diftribution of the veffels which fhould determine us to prefer one extremity to the other. And, in fact, if by any accident the right arm comes to be difabled, perfons very readily learn to give the left leg the preference in performing the motions; and this

may ſerve to confirm the reaſon of the preference
mankind in general give to the right arm, that the
particular diviſion of the aorta has a ſenſible
effect. The aorta runs outwards not in a direct
line to the thigh, but in order to avoid the cavity
of the pelvis a conſiderable angle is formed, and
the blood ruſhes againſt the diviſion with con-
ſiderable force; and this may explain what we
find, that, next after the beginning of the aorta
from the heart, the diviſion of it at the iliacs is
moſt ſubject to diſeaſe.

CCCCXCVI.

Here we can judge of the proportion which
branches bear to the trunk; and from this divi-
ſion we would ſuppoſe that the common compu-
tation made is nearly juſt, that the branches put
together exceed the trunk by one half.

CCCCXCVII.

The principal artery of the uterus is the hypo-
gaſtric, and from its ſituation an experiment has
been propoſed, to make preſſure on the femoral
artery, in order to promote the menſtrual diſ-
charge; and though we are not to expect ſo much
as has been imagined from this, becauſe we do
not find that a ſudden increaſe of the force of
the blood always cauſes the menſtrual diſcharge;
yet that may be ſuppoſed to concur, whilſt other
circumſtances are favourable, and therefore in
many caſes the experiment ought to be purſued.

It is evident that the preſſure upon this artery muſt increaſe the momentum of the blood in the uterus, and in many caſes at leaſt promote the diſcharge.

CCCCXCVIII.

In both ſexes we ſee a branch ſpent upon the middle of the inteſtinum rectum, whilſt other branches are furniſhed to the extremity of the rectum. Now it is evident, that the common account of the cauſe and frequency of hæmorrhoids is by no means juſt, that the blood returns difficultly through the vena portarum, for their moſt common ſeat is ſupplied from the aorta, and the blood is returned by the vena cava; ſo we muſt find ſome other cauſe. In a few caſes, the diſcharge, perhaps, is made higher; and the difficulty of the return through the vena portarum may render the diſcharge more copious.

CCCCXCIX.

A branch deſcends from the internal to the external organs of generation, and the ſituation of the artery with reſpect to its vein is particular, the elevator coming in between them; hence the erection of the penis is in a great meaſure owing to the action of that muſcle, and the ſame applies to the female.

D.

The laſt branch of the internal iliac ſupplies the muſculi glutæi. An aneuriſm is ſometimes formed

under the glutæus maximus, occupying the back of the great trochanter. An aneurism may remain long in the fame fituation, and therefore we fhould not be too rafh in forming a prognofis.

DI.

The external artery is lodged at the fide of the pfoas mufcle, protected as much as poffible from the preffure of the bowels in the pelvis and abdomen; and the artery here runs external to the vein, perhaps becaufe the artery fuffers lefs from preffure than the vein would have done. We fometimes fee, from the effect of the preffure, ædematous fwellings produced in the legs.

DII.

The artery at length gets behind the tendon of the oblique, and fends off two confiderable branches, the circumflex artery, and the epigaftric artery. We find the latter covered by the inguinal glands, to which it is tied by cellular fubftance; and, therefore, in treating thefe by operation, we fhould be particularly cautious; even cauftic laid along, might go fo deep as to reach the coats of the artery; and therefore it is fafeft to treat buboes, &c. by incifion.

DIII.

At this place the artery is fituated directly over the head of the thigh bone, covering the round ball. Hence furgeons have been deterred from making incifions into the cavity of the joint to

difcharge matter, &c.; and it is certain that an
incifion cannot be made into a joint or ligament
without a confiderable degree of danger, yet the
danger from the effect the matter has upon the
ligaments, inflaming them, producing hectic fymp-
toms, &c.: or, from its making its way into the
pelvis through the focket, &c. may be greater,
efpecially as we can make the incifion without
wounding the arteries or nerves, as the capfular
ligament of the thigh does not merely include the
ball, but takes in the neck of the thigh bone;
fo we can make the incifion at the outfide of the
beginning of the fartorius mufcle; and of the
tendon of the iliacus internus, at the moft de-
pending place, where the matter will be moft
readily difcharged.   Lower than this, it gives off
its circumflex branches which communicate with
the internal iliacus; and if, by any accident, the
femoral artery fhould be wounded, we may not only
fave the life, but the limb, and are not to think
of amputating at the top of the thigh, which, from
the quantity of blood loft, the number of nerves,
&c. is attended with the utmoft danger; fo we muft
attempt to tie the artery, in the hopes that the
branches may convey as much blood as is necef-
fary; and going lower, the profpect of fuccefs
continually increafes, becaufe of the more numer-
ous anaftomofes.

DIV.

As the artery paffes downwards to the ham, it lies near to the bone, fo we can ftop the blood with a tourniquet, by prefling the femoral artery againft the bone.

DV.

We attend to the exact fituation of the arteries, in order to find them after an amputation. There is no difficulty of finding the trunk of the femoral one in the thigh; but in the leg, two of the arteries are more connected to membranes; the anterior tibial is connected to the interofleous membrane in fuch a manner, that it requires attention to detach it. The difficulty of raifing this is fuch, that the furgeon fometimes ties the thread round the bone; but that includes the periofteum, and feveral threads of the mufcles. . And as the nerves are divided here minutely, fome of the membranes may be taken in.

DVI. ·

When we trace back the blood from the foot, we obferve the fame general ftructure as in the arm; only the deep-feated veins are larger, and the outer ones of courfe fmaller. From the greater activity of the fuperior extremity performing more varied motions, fo the blood is more in danger of being ftopped, and the deep veins do not divide into fo many branches; but they are larger, and therefore a furgeon in performing

amputation will be under the necessity of tying the veins, as well as the arteries, if the amputation is immediately above a pair of valves, the neighbouring veins pouring in their blood.

DVII.

The last general remark upon the blood vessels here is, that the coats, both of the arteries and veins, are remarkably thicker than in any other place of the body; and from this we may conclude, that the force of the heart is not so very immense as many physiologists have supposed, otherwise the addition of a few feet of column would not have made so great a difference. We see the effect of the column in dropsical swellings more readily appearing in the feet; and we can account for that, without supposing that the branches of the red veins absorb, for there is a greater pressure made upon the lateral branches of the arteries, and the swelling may be owing, not to a want of absorption, but to an increased exhalation; and taking in the lymphatic system, we see that the absorbed liquors return more difficultly.

DVIII.

But notwithstanding of the increase of the thickness of the coats, the veins of the lower extremities are more subject to varix than the upper, for they are subject to more unequal pressure; they are acted upon by many muscles before

the blood returns to the heart, and the preſſure made by the contents of the abdomen is very un-equal, even a preſſure made by dreſs will have the ſame effect as a diſtention of the bowels in the abdomen.

DIX.

To conclude our account of the veſſels and nerves of the inferior extremities, the anterior branches of the nerves are by much the largeſt, particularly in the trunk of the body : the muſcles are ſupplied by a number of minute branches, none of which are of ſuch conſequences as to prevent a ſurgical operation : and every one of the long muſcles is ſupplied from a number of nerves ; and, inſtead of flexion being performed by one nerve, and extenſion by means of a different nerve, we ſee them ſupplied by the ſame nerve, and a ſingle flexor or extenſor ſupplied from a number of roots.

DX.

When a ſtone deſcends through the ureter, croſſing obliquely the anterior branches of the nerves in the loins, the cremaſter muſcle is thrown into action, and drawn upwards. We are not to ſuppoſe that the ureter can make mechanical preſſure upon theſe nerves. But, firſt, an irrita-tion is communicated to the neighbouring parts, an inflammation is excited, and ſuppoſe the hy-draulic ſyſtem detached from the nervous, we

fhould not obferve any contraction of the cre-
mafter; it is from an inflammation fpreading
more readily to the neighbouring organs: and the
bending of the body forwards, which takes place
in an inflammation of the pfoas mufcle, chiefly
proceeds from the eafe the patient finds in that
pofture by the parts being relaxed, and not that
the mufcle is in a fpafmodic and convulfive action,
for the patient can, though with difficulty and
pain, extend the body behind the pfoas.

DXI.

In the fmall nerves of the extremity thofe are
to be avoided carefully that run upon the fides of
the fheaths of the tendons.

DXII.

Anatomical Preparation of the Extremities.

The fuperior extremities are to be removed from the
trunk.   The clavicle is raifed for this purpofe, and the
knife paft under the articulation, fo as to include the
greater part of the pectoral mufcle; and, by directing
it under the fcapula, the clavicle, fcapula, and fubfcapu-
laris mufcle will alfo be removed.   A pipe is then to be
fixed in the axillary artery, which becomes divided by
the feparation of the parts, and another pipe is to be
inferted in one of the veins on the back of the hand;
and having previoufly wafhed out the blood from the
veins, the injection is to be conducted in the ufual
manner, preventing its paffing out in the time of the
operation from the axillary vein, over which a loofe
ligature fhould be thrown.

The lower extremities are to be removed by opening the abdomen, and removing its contents, or placing them out of the way. A section is then to be made through the symphysis pubis and its ligaments, and next through the ilium and sacrum, so that along with the extremities one side of the pelvis may be removed. In injecting, the pipes are then to be fixed, one in the iliac artery, and the other in one of the large veins of the foot, as near as possible to the toes. The preparation is then to be finished in the usual manner.

Anatomical Preparation of the Hand.

An old emaciated female hand is the one preferable for this purpose. The forearm is to be separated by a transverse section above the wrist, and the steel pipe fixed in the radial artery with a ligature. The quick-silver being poured into the tube, will soon fill all the vessels, and begin to flow out where the section is made, and will thus remove any coagula. The vessels are next to be secured, first catching them by the forceps, and applying a ligature over each, first over the arteries, and then over the veins. If not sufficient, a general ligature, as a tourniquet, may be applied over the arm. When the vessels are thus secured, the preparation is to be suspended in water for a day without removing the pipe or ligature. The latter are then to be removed. Putrefaction is to be allowed to take place till the cuticle peels off, when the part is to be suspended in the air to dry, and when dry carefully varnished. By such preparations a beautiful display of the vessels is afforded.

DXIII.
Lymphatic Veffels.

To finifh the defcription of the vafcular parts, one fet of veffels, or the appendages of the thoracic duct ftill remain, termed the lacteals and lymphatics, univerfally diftributed over the body.

· DXIV.

Thefe veffels are fmall pellucid tubes, which begin by numberlefs open mouths, vifible only by the afliftance of glafles, arifing every where from the furfaces, both external and internal. They feem every where to run in two fets; a fuperficial one, the branches of which are moft numerous; and a deeper one accompanying the arteries, and in a double proportion at leaft to the latter. They are termed lacteals on the infide of the inteftines from the white liquor or chyle they contain, and they are termed lymphatics wherever they are not filled by this fluid.

DXV.

Their general termination is in the thoracic duct, already defcribed, and in no other parts of the venous fyftem do they appear to terminate.

DXVI.

The texture of the abforbents feems ftronger than that of the red veins, though it is too minute for a particular examination. Their mufcular power is apparent from their action, and by this power are their contents conveyed from their origin

to the thoracic duct, and urged on alfo by the
motion of the furrounding parts. They are fur-
nifhed alfo with blood veffels and nerves like the
larger veffels, as difplayed by their fufceptibility
both of inflammation and pain.

DXVII.

From their frequent communications and anaf-
tomofes with each other in their courfe, they in
general form an irregular net-work, which is moft
numerous in the vicinity of the glands, into which
they divide.

DXVIII.

Their whole extent is intercepted by valves of
a femicircular form, placed in pairs, with one
edge fixed and the other loofe acrofs the cavity of
the veffel, but pointed towards the general termi-
nation. The fituation of the valves is not always
regular, or at certain diftances, nor is their num-
ber always the fame in the fame fpace, though
7 or 8 are the ufual number in the length of an
inch. Their number varies both in different bodies
and in different parts of the fame body. The fize
of the veffels, when diftended, is always largeft
on the fide of the veffels towards their termination.
Hence their jointed form in the lymphatics, and
veficular appearance in the lacteals; and at the
point of their termination there is always one or
two fets of valves to prevent any regurgitation
into them. Thus the valves promote the courfe

of their fluids, and prevent the regrefs of their contents as they pafs on. By this fet of veffels all fluids applied to their origin are taken up in confequence of capillary attraction, and urged on by the power of the veffels till carried into the general mafs.

DXIX.

The glands connected with the abforbents are peculiar in their ftructure. Their fituation in various parts of the body is under the fkin, in the cellular membrane, or over the trunks of the different blood veffels belonging to the vifcera. Their form is round, or oval; their fize never exceeds an inch in diameter, and they are often collected into a mafs, varying in colour in different parts, and at different periods of life, being large and reddifh, or brown, in youth, but fmall and pale with increafing age. Under the fkin, alfo, they are redder and firmer than within the large cavities, and are covered by a fmooth denfe membrane, which gives them a fhining appearance, and is connected to the glands by cellular membrane.

DXX.

Thefe glands, like others, are provided with blood veffels and nerves; and they poffefs fometimes internally a cellular appearance, at other times they confift of a fimple convolution of veffels. The abforbents entering the gland, as they ap-

proach it spread into radiated branches, termed vasa inferentia, and then penetrate its substance. From its opposite side, vessels go out in the same manner as they entered it, termed vasa efferentia; but they are larger and fewer than the former. Many of the absorbents enter several glands before passing into the thoracic duct, and by these glands a change is certainly made on their contents; the particular nature of which is not yet ascertained.

DXXI.

In examining the distribution of the lymphatic, or absorbent vessels, the superficial set of the lower extremities which lie between the skin and muscles belongs, in general, to the teguments. Round the toes they form a plexus, and the same on the foot, from which branches run along the knee. The same takes place on the outer as on the inner side; and the branches here divide, one part crossing the tibia, and joining the same set at the knee; the other part, passing into the popliteal glands, and thence ascending, in part, to the thigh, which glands are near the artery, and buried in fat.

DXXII.

From the knee a plexus from 12 to 14 trunks passes to the groin by the fore and inner part of the thigh, accompanying, in their course, the great saphena, and receiving branches from the adjacent parts in their progress, till they pass into the

inguinal glands, which are from 6 to 12 in
number, of different fizes, fituated in the angle
between the thigh and abdomen, and part further
down on the fore part of the thigh. The fuper-
ficial lymphatics are chiefly centered in the loweft
glands; and into this clufter pafs alfo thofe of the
thigh, nates, abdomen, and loins.

DXXIII.

The deep fet of the lymphatics of the lower
extremity are few in number; they occupy the
blood veflels in their progrefs, and, like the former,
pafs into the popliteal glands; and, as they pro-
ceed up, they accompany the femoral artery, and
enter alfo the inguinal glands.

DXXIV.

Of the fcrotum, the fuperficial lymphatics enter
likewife into the inguinal glandular clufter, and the
deep feated ones are carried, with thofe of the
tefticle, into the abdomen. The fuperficial lym-
phatics of the penis run principally on its back,
receiving branches from its inferior furface; and
at its root they divide into right and left, paffing
on each fide into the lower glands of the groin.

DXXV.

The deep feated fet from the glands and body,
accompany the arteries into the pelvis.

DXXVI

The tefticle is diftinguifhed by the largeft and

moſt numerous lymphatics in the body, ſome of which exceed in ſize a ſmall quill. They ariſe from the coats, body of the teſticle, and epidi-dymis, and paſſing into the ſpermatic chord, they terminate in the lumbar glands. The lymphatics in the internal parts of women go partly to the inguinal cluſter, and partly by the courſe of the round ligaments, and they terminate in the iliac, or lumbar glands.

DXXVII.

All the ſuperficial lymphatics of the under part of the belly, loins, nates, and round the anus, paſs into the inguinal glands ; and theſe glands, thus ſupplied, ſend out but a few larger trunks in return, which enter the belly under Poupart's ligament, in company of the iliac artery. Having entered the abdomen, they are variouſly diſtri-buted to the glands above the iliac and lumbar veſſels. The iliac glands being equal to thoſe in the groin, and the lumbar larger, and lying over the great veſſels and lumbar vertebræ ; and in theſe glands alſo all the other lymphatics of the inferior extremity terminate, from whatever quar-ter they come.

DXXVIII.

Beſides theſe lymphatics, now deſcribed, on the inſide of the iliac artery, others are ſituated ; on the outſide of it on the pſoas muſcle, one part part of which paſſes by to the lumbar plexus into

.the thoracic duct; another part forms a plexus on the facrum, and from that proceeds to the fame termination.

DXXIX.

The lacteals again begin on the inner furface of the inteftines, each beginning upon one of the villi by fhort branches, which are furnifhed with orifices for imbibing the chyle. From the villi, their progrefs is along the outer coat of the inteftines, which they obliquely penetrate at laft, after uniting into larger branches in their courfe. Their progrefs accompanies that of the blood veffels, to which they are double in number, one being placed on each fide of a veffel; and both the fuperficial and deep-feated lacteals communicate in the fubftance of the inteftines; and, on leaving the inteftines, between the folds of the mefentery and mefocolon, they form a plexus, without regard to the courfe of the veffels. In their progrefs they pafs through a number of lacteal and mefenteric glands of different fizes, the latter being feated in the part between the layers of the mefentery, and fcattered over it at the diftance of two or three inches from the inteftines, of a white colour, and flattened before. The lacteals are largeft on the jejunum, and the glands are alfo largeft on that part of the jejunum connected with the mefentery.

DXXX.

By the fize of thefe glands the lacteals have been divided into different orders. From the inteftines to the glands forms the firft order; one fet of glands to another forms the fecond order; and from the glands to the thoracic duct forms the third order.

DXXXI.

The fmall inteftinal lacteals, on leaving the mefenteric glands, in three or more large trunks accompany the mefenteric artery, and pafs in, for the moft part, at the beginning of the thoracic duct. The large inteftinal lacteals are centered in the mefocolic glands, and thofe of the cæcum and right colon communicate with the fmall internal lacteals; while thofe of the left colon accompany the mefenteric artery, and are loft in the lumbar glands.

DXXXII.

The ftomach poffeffes two fets of lymphatics proper to each of its curvatures. The lacteals of the fmall curvature accompany the fuperior coronary artery, pafs into the glands of the omentum minus, and obferving the fame courfe with thofe of the liver, terminate in the thoracic duct. The lacteals of the great curvature go to right and left. The right fide lacteals joining thofe of the great omentum, and the plexus accompanying the coronary artery, run with the lymphatics of the liver

to the duct.　The left fide lacteals join thofe of
the fpleen and pancreas, and accompany them into
the duct.

DXXXIII.

The lacteals of the liver run alfo in two fets,
which freely communicate, and they are fo nu-
merous as to cover almoft the whole of its
outer furface.　They difcharge their contents part-
ly into the beginning of the thoracic duct, and
partly to a plexus fituated on the fore part of the
thorax.

DXXXIV.

The fpleen alfo poffeffes two fets of lacteals.
The fuperficial fet is remarkably fmall.　They
pafs from its convex to its concave furface, and
join the deep feated ones at the fiffure where
the blood veffels enter, and they afterwards pafs
through feveral glands, lying over the fplenic ar-
tery.　The lymphatics, alfo, of the fpleen, receive
thofe of the pancreas, which run into them, and
the whole goes into the thoracic duct, near the
termination of the lacteals.

DXXXV.

The fuperficial lymphatics of the kidney are only
vifible in it when it is under difeafe.　They run
from without inwards, and terminate in the lum-
bar glands, and fo at laft in the duct.　Thofe of
the renal glands join the lacteals of the kidney.

DXXXVI.

The lymphatics of the lungs are numerous. The superficial set forms large areolæ, with smaller ones within them. The large set runs chiefly between the lobules, while the small passes so as to cover the whole substance of the lungs. · From the surface they pass to the root of the lungs, and enter the bronchial glands already described, (CCCXVI.), where they are joined by the deeper set that creep along the branches of the trachea and pulmonary blood vessels, and through the medium of the bronchial glands the two sets communicate. On leaving the bronchial glands, those of the left lungs terminate partly in the thoracic duct behind the trachea, and another part passes through glands behind the aortal arch, and run by one trunk into the duct. Part of those of the right side, after a convoluted course on the vena cava, opens into the trunk which terminates in the veins at the right side of the neck, and the rest go into the duct near the division of the trachea.

DXXXVII.

The absorbents of the heart are numerous, but small. Their principal trunks accompany the coronary arteries, the largest belonging to the left ventricle, and they all pass to the neighbouring glands.

DXXXVIII.

The lymphatics of the æsophagus are numerous, and intermix with those of the heart and lungs.

DXXXIX.

The fuperior extremities, like the inferior, have two fets of lymphatics, one lying under the fkin, the other accompanying the principal blood veffels.

DXL.

The fuperficial fet is numerous, and arife from the fore and back part of the finger and hand, forming an extenfive plexus on the correfponding fides of the facrum. Thofe of the anterior part obferve a direct courfe upwards, while thofe of the pofterior feparate and pafs obliquely. From the bend of the elbow the firft accompany or run near the bafilic vein, and enter fmall glands in the courfe of the humeral artery; others do not communicate any where till they enter the axillary glands. Some branches attend alfo the cephalic vein, and afterwards pafs into the glands at the clavicle. The deep fet accompany each principal artery, and uniting at the elbow, pafs on in two large trunks along with the humeral artery.

DXLI.

The axillary glands form a clufter, varying in number and fize, though lefs than thofe of the groin. They are furrounded by much fat, and adhere clofely to the trunks of the axillary blood veffels and nerves. From them large branches enter the clavicle, and form a trunk which joins the duct near its termination on the left fide.

o 4

The axillary glands receive the fubcutaneous lymphatics from the back part of the thorax, of the teguments and mufcles of the fcapula, and alfo from the mamma.

DXLII.

The lymphatics of the mamma are numerous; though the greater part paffes through the axillary glands, others penetrate the interftices of the ribs near the fternum, and enter glands that pafs with the internal mammary veffels.

DXLIII.

The lymphatics on the outfide of the head accompany the blood veffels, and enter glands as they proceed to the neck; and then others, partly connected with the parotid gland, and fome at the root of the zygoma. The lymphatics of the back part of the head enter glands at the root of the ear. Thofe of the fore part accompanying the facial artery, and its branches, pafs into different glands fituated at the buccinator mufcle, at the under part of the lower jaw, maffeter mufcle, and the inferior maxillary gland.

DXLIV.

The lymphatics from the inner nofe pafs with the maxillary artery, and enter glands behind the angle of the lower jaw, where they join thofe of the mouth. The lymphatics of the tongue and proftate centre in the glands behind the angle of the lower jaw.

DXLV.

The exiftence of lymphatics in the brain is highly probable, though not yet decifively afcertained.

DXLVI.

All the lymphatics of the head accompany the large veffels in the neck, forming in their courfe a remarkable plexus of numerous glands, fituated near the blood veffels, termed glandula concatentæ, which are more numerous than any fet in the body, and unite at the bottom of the neck into a trunk, which enters the duct on the left fide, near its termination, and on the right goes into the trunk that forms the general termination of that fide.

DXLVII.

Having thus traced the courfe of the lymphatics, fomething faither is neceffary with refpect to their general termination in the duct. At its under extremity the duct is compofed of three principal trunks. The firft and fecond confifts of the lymphatics of the right and left inferior extremity, and the third is joined by the lacteals or inteftinal veffels. From thefe is compofed the duct over the 3d vertebra of the loins. In the thorax, the duct in addition receives the lacteal trunks of the intercoftals of the æfophagus and of the lungs; and paffing over after leaving the thorax to run between the longiffimus colli and internal jugular

vein, it next makes a turn down to terminate in the angle formed by the left internal jugular and fubclavian vein. In its whole courfe it obferves a waving direction; and after leaving the thorax, fometimes divides into two.

DXLVIII.

Chemical Analyfis of the Contents of the Lymphatic Syftem.

The contents of the lacteals were already examined under the name of chyle.

The lymphatic veffels, again, contain a colourlefs fluid, or a gelatino-albuminous water, having no tafte, and of a thin and fomewhat plaftic confiftence, being a folution of the fuperfluous gelatin and albumen from every part, and the fuperfluous aqueous vapor returned as it were to pafs anew through the general circulation, and to affimilate as it enters the thoracic duct, the chyle or nourifhment on its primary entrance into the fyftem.

DXLIX.

Anatomical Preparation of the Lacteals.

The fubjects moft proper for lymphatic preparations are thofe who have died anafarcous; and in order to difcover thefe veffels, make an incifion in the cutis, and remove it as far as the cellular membrane. In this part a magnifying glafs will obferve them, and then with the point of a lancet cut an orifice in one of them, into which introduce the pipe, which is to be kept in that fituation by the finger, or a ligature; and when the cock is turned, the quickfilver will be feen to run up the lymphatics. As long as the column of mercury continues to leffen gradually, we are to hold the pipe in its fituation; and when it ceafes to run any

longer, the injection is to be secured by a ligature, and the pipe withdrawn. The exit of the mercury from any collateral branch, is farther to be prevented by a needle and ligature. The injection being thus finished, the course of the vessel is to be cautiously traced with the sciffors and forceps, avoiding any injury to the vessel; and should it take place, it is to be repaired by securing the injured part by the finger and thumb, and passing a fine ligature above and below the part.

During the progress of making lymphatic preparations, which are slow and tedious, the parts should be prevented from drying by avoiding their exposure to the air, or covering them with a wet cloth. When the preparation is finished, and cleared of all fat and extraneous matter, it should be dried in the air without heat, and when dry, varnished.

All the lymphatic preparations are made in the same manner.

DL.

Having now treated at length the structure of the animal body in a found state, and its different parts, it will be proper to take a general view of the three great systems which support it, the vascular, absorbent, and nervous, in a connected manner.

DLI.

General View of the Vascular System.

Beginning then with the vascular system, we observe the coats of the arteries are of a considerable thickness; and as these require nourish-

ment and growth like the reſt of the body, numerous ſmall arteries are diſtributed on their coats, what writers call vaſa vaſorum. The coats of the pulmonary artery are ſupplied from the aorta.

DLII.

Structure of the Arterial Coats.

When the coats are diſſected, upon the outſide, beſides common cellular ſubſtance, or in ſome places the addition of membranes laid over the artery, as in the pleura within the cavity of the thorax, there is a looſe cellular ſubſtance every where; and on ſeparating it, we obſerve that the outer part of an artery is of a whitiſh colour. This whiteneſs depends on a tough and elaſtic coat, in which a number of exceeding minute fibres are interwoven in all directions, ſo that this outer coat may very properly be conſidered as cellular ſubſtance condenſed; for the fibres do not appear to run more in one direction than they do in another, ſo we ſhall call it cellulo-membranous, or the membranous external coat, which is of conſiderable thickneſs. This raiſed, we find within it one without fibres laid tranſverſely, or in a circular manner. Theſe are of a pale red colour, or paler than the principal muſcles of the extremities; ſo, examining the femoral artery, we find fibres of a paler colour than the muſ of the extremities, but very diſtinct; but it certainly carrying matters too far a great de

when the coats of an artery in general, or all the coats, are confidered as being cellular fub-ftance condenfed.

DLIII.

To judge from appearances, the name of muf-cular is properly applied to this coat; and there is no more reafon, from any thing we obferve, to fuppofe it compofed of cellular fubftance, than to fuppofe any of our mufcles to be fo. Within the fibrous mufcular coat we find an inner coat, or we find this lined with an inner coat which is extremely thin, but very denfe; neither is it ftrong, and it has lefs toughnefs than we fhould have expected, having fcarcely any of the elafti-city proper to arteries; for, if the outer coats are diffected, it fcarcely admits of being ftretched; and thefe three coats are connected to each other by the common cellular fubftance of the body, as in the alimentary canal, &c. In other animals, as that of the ox, and efpecially in the whale, the fibrous coat is ftill more evident and diftinct.

DLIV.

Next, in the coats and ftructure of the veins, thofe of the fmall ones are fo thin and tranfparent, that we cannot diftinguifh the one from the other; but in the larger veins we find nearly the fame number. The fecond is fomewhat reddifh co- red in the larger veins. In it we can diftin-guifh fibres, but very different from the fibres of

an artery; for they are not placed chiefly in a circular manner, but so many run length ways; these are crossed by others, and the threads of both are interlaced; so that we are at a loss, judging of it merely by infpection, to determine the nature of that coat.   Next the blood is a membranous thick coat, which is tougher than that within the arteries; and the elaflicity of the veins very much depends upon the inner coat, whereas in the arteries it depends chiefly upon the outer coat.   The cellular fubflance, too, is rather loofer, fo that we can feparate the external coats eafier from the internal than in the arteries.

Such is the general flructure; and from it we proceed to trace the courfe of the blood.

DLV.

In refpect to the fhape of an artery, many authors have defcribed it as if it was conical; but if we attend to it, in any place where minute branches are not fent off, we find it cylindrical; or we may compare an artery to a tree, which we are likewife apt to imagine of the conical fhape, not attending to the change made by the wood furnifhed to the branches from the trunk, for between the branches it is likewife cylindrical.

DLVI.

In regard to the mode of ramification, or the proportion in which an artery branches, compared with the trunk; as on the right fide of the

neck, for inſtance, and at the bottom of the abdo-
men, it is evident that the two branches joined
together are larger than the trunk, and the pro-
portion nearly, as commonly alleged, is as three to
two ; the two joined together are a third larger
than the trunk which forms them.   Hence, as we
find ſuch diviſions, and ſubdiviſions of arteries,
frequently repeated, as in the meſentery, the ſum
of all the ultimate branches of an artery, or their
capacity, muſt be conſiderably greater than that of
the trunk ; and therefore, inſtead of conceiving that
the arteries are conicals with the baſis turned to-
wards the heart, we may juſt invert this, and
compare the arterial ſyſtem to a cone with its point
beginning in the heart, and the ſize continually
increaſing to the moſt diſtant extremities.

DLVII.

With regard to the kind of angles which the
branches of the arteries form, in general we may
obſerve that the blood enters them in a favourable
direction, or that the angles are acute ; but in
this there is the utmoſt variety, which partly de-
pends upon neceſſity and ſituation, partly upon
the uſe which the arteries ſerve ; for in many
places we find them ſent off nearly at right angles,
and in ſome few the angle is turned back in the
moſt unfavourable way, the blood moving retro-
grade, as it were.   Upon the whole, we may
obſerve, that near to the heart the angles of the

arteries are greater than at a diftance. Nature feems to endeavour to render the flow in all as equable as poffible. So we find many arteries of the trunk that are deftined for mufcular organs, fent off nearly at right angles; whereas, in the extremities, they are almoft every where acute. Perhaps, further, we may remark, that near to the heart the arteries arifing from the trunk are fpread out in a greater number of branches. Following an artery to the place where it is intended to be diftributed, we frequently find, almoft without exception, that the neighbouring branches communicate, or we difcover a beautiful net-work of the branches, as in the alimentary canal; fo that, although a number of branches were ftopped, the blood could penetrate to the extremities of every branch; and if, in the courfe of the artery from the heart to the diftribution, there is any danger of a confiderable ftoppage, we find confiderable anaftomofes in the large branches, as in the mefentery.

DLVIII.

It is impoffible to trace, by diffection, the arteries to their ultimate termination with our fenfes unaffifted. A microfcope is required to view the circulation in a living animal; for, if we attend to the circulations that have been made by the moft eminent phyfiologifts, it is proved to our fatisfaction, that three or four thoufand of fuch

arteries as circulate red blood laid together, do not exceed the breadth of an inch; or, that the fmalleft hair exceeds the diameter of the artery at leaft in the proportion of twenty to one ; or, that four hundred fuch arteries circulating the red globules joined together, would not be larger than a fingle hair. Hence, after we have forced an injection from the arteries into the veins, or into the moft minute branches of the arteries, we perceive little more than an uniform red colour with the naked eye, as in the innermoft coats of the alimentary canal.

DLIX.

The veins returning from the extremities of the body, in their firft origin imitate the arteries in their appearance, and there muft be the fame number of them. There are two fmall anaftomofes, which are occafionally repeated in the progrefs of the veins towards the heart; and thefe anaftomofes are, in general, more frequent in the veins; for, as the force of the blood is lefs here than in the arteries, there is a greater danger of its ftoppage. And, for the like reafon, where the veins are fubjected to unequal preffure, as where they run among mufcular organs, in the trunk of the body, the head, and extremities. Within the veins there are numerous valves, or flood gates; and wherever the veins appear joined, there a pair of valves are to be found. Nor is

this alone fufficient; but in the mufcular parts two fets of veins are confpicuous, one following nearly the courfe of the arteries, and the other running under the fkin; where they are as little expofed to the action of the mufcles as poffible. And not only do thefe anaftomofes take place, but we find branches paffing from the one to the other, fo that on opening a vein the flow of the blood is increafed by caufing the patient to play with his fingers, which puts the mufcles in action, and preffes upon the deeper veins. When the veins are traced from all the parts of the body to the heart, we find that the two venæ cavæ, joined together, are confiderably more capacious than the aorta, nearly in the proportion of two to one, for the inferior is nearly as much larger than the aorta, as the fuperior is fmaller than it. With this general ftructure we are led to confider the action of the parts by which the circulation of the blood is performed.

DLX.

That the blood is carried conftantly in a circle, appears from the vafcular ftructure which directs it in its courfe. We find valves at the mouth of the ventricle of the heart, at the mouth of the arteries, and in many places of the veins; and, again, where the inferior cava terminates in its correfponding auricle. If we examine living animals, this is made ftill clearer. We find proof

of the motion from ligatures made upon the veffels, or from wounds inflicted, or from the transfufing the blood out of the body of one animal into another's body ; or we fee proof from the infufion of medicated fubftances, which, when poured into a fingle vein, or artery, affect the body univerfally, and the blood may be fhewn moving with the microfcope.

DLXI.

The rapidity of the motion is likewife eafily demonftrated. Thus we fee, that a vaft quantity is loft from a wound made even in the correfponding artery, the difcharge would be greater, becaufe the veins are more capacious than the arteries, and therefore the flow of blood is flower; or we fee the proof from the transfufion of the blood ; or without any regard to experiments, we have only to attend to the quicknefs of the pulfe, to the frequency of its ftrokes, and to the capacity of the heart. From them we perceive that a prodigious quantity is paffing through the heart in a very fhort fpace of time, our pulfe beats between 60 and 70 times in a minute ; when a perfon is laid at reft in bed, fuppofe it 64. Thus, if a fingle ounce of blood be thrown out from the left ventricle of the heart in each pulfation, it is evident that there paffes through the heart in a fingle minute 4 pounds of blood ; but if we double the quantity, which from the fize of the ventricle we

may eafily do, eight pounds may pafs in a minute ; therefore, in the fpace of an hour, blood, equal in weight to thirty ftones, or perhaps to three times the weight of the animal to which it belongs, paffes in that fpace.

DLXII.

This velocity of the blood depends upon the action chiefly of the auricles and ventricles of the heart ; and thefe act alternately. Whilft the auricle is filling from the veins, the ventricle is emptying itfelf ; and whilft the auricle empties itfelf, the ventricle is filling ; and the ufe of each is clear, in order to give room by their being a receptacle added to the heart. There is no alternate confiderable dilatation of the veins ; for, whilft the ventricle is in action, the blood continues to flow, as before, from the veins into the auricle ; and as foon as the ventricle ceafes from its action, the auricle, now ftimulated by the blood, contracts, and the blood flows into the ventricle with great quicknefs, whilft, at the fame time, an addition is made from the veins. Hence the auricles are fmaller than the ventricles, and there is nothing placed to prevent the flow of blood continuing into the auricle directly from the veins during the contraction of the ventricle.

DLXIII.

What is known of one fide of the heart applies to both. We conceive that the two auricles are·

filled and emptied at the fame time, but at a time different from the ventricles ; having, as appears from this, a common feptum, and we cannot fuppofe that the half is relaxed, and the other in action. Indeed, the fynchronous actions of thefe parts may be feen in a living animal. But though the auricles and ventricles are emptied at the fame time, they are not entirely emptied, but nearly fo ; for the right fide is fomewhat more capacious than the left, fo this certainly does not empty itfelf fully, but they do very nearly ; and, we may fay, that the auricle is filled and emptied alternately. But our blood veffels are in a very different ftate. The fides of the arteries do not come into contact when in action, only they are more ftretched at one time than at another, and are more ftretched when the ventricle is in action ; but they are by no means emptied when they contract, and this leads us to attend to the caufe of the pulfe.

DLXIV.

When the finger is applied to the artery, it is underftood, in general, that the artery ftrikes the finger, becaufe the blood is driven from the heart into it with violence. But, farther, what changes does this produce ? Are we to fay, that the artery is merely dilated, its diameter increafed ? Or, are we to fay, that it is not dilated, but lengthened, in confequence of which it

changes its place? Or, are we to adopt both? We certainly muſt; for to imagine that an artery is not dilated, is improbable. We find that it can be drawn out in its diameter, as readily as in the length, and it re-acts with conſiderable force; and the muſcular fibres, on which the elaſticity in a great meaſure depends, are placed in a circular manner. It is in vain to allege, that when we make a computation, the quantity of blood that the heart ſupplies appears to be inconſiderable, conſidering, at the ſame time, the great capacity of the arteries; and, therefore, that the change in dilating them cannot be obſerved. For, in this computation, it is taken for granted, that the whole is diffuſed univerſally in the arterious ſyſtem; but the arteries beat ſucceſſively: and, if one hand is laid on the carotid artery on the neck, and another upon that on the top of the foot, it will be perceived that the one ſuccecds the other, and the dilatation, as well as the elongation and change of place in the artery may be plainly ſeen; but both ſeems leſs to the eye than to the finger, for we are affected by the force of the percuſſion, and imagine the motion greater than in reality it will be found to be. Hence, when we throw an injection into it, the artery, inſtead of becoming ſhorter and ſtraighter, is lengthened out, becomes more ſerpentine, and at the ſame time is dilated.

DLXV.

By what powers, after the arteries have given a ftroke to the finger, do they recover their former fituation ? Is it merely by their elafticity, or that whilft they are elaftic, they are likewife mufcular? Their elafticity is known, and the ufe of it is apparent; it is intended to prevent the whole force of the heart from being fpent : the force is eluded by the yielding of the larger branches, and the impulfe is continued, inftead of being given in one moment. Nothing is loft, and nothing is added by the elafticity. The force is as much loft by the yielding, as it is increafed by the re-action; the force is the fame, but divided; part of it is employed when the heart is in action, and then it is continued when the heart ceafes.

DLXVI.

With this elafticity a mufcular power is joined, for the fibrous coat is truly mufcular; and we may, therefore, with certainty conclude, that the arteries are mufcular organs capable of irritation, of varying their action occafionally in health, and in difeafe; and the proof of this is full and complete. The contractions of arteries are apparent when irritated, and a greater motion is performed at the place irritated than elfewhere. In many inftances this cannot be fhown fo clearly as might be expected ; but the fame is true in other organs. ·Thus it has been found, that the vefica urinaria

may, on certain occasions, be wounded and cut on the outer surface without suffering a contraction of its fibres; and many difficulties are to be had in view here. If a ligature is thrown upon an artery in order to intercept the blood, that it may be seen what passes beyond the ligature; or an incision is made, then may have been compressed or divided those very nerves on which the motion of the cut muscle depends. The irritation, too, is applied not in the natural way. It has been made upon the outer side, whereas, if applied to the inner side, the effect may be very different. Thus, whilst the arteries possess the muscular power, they possess at the same time the elastic; and it is by no means improbable that in several places the elasticity straightens the artery as much as the muscular power can do, so that it is not made smaller in life, but a greater impulse only is given to the blood. If these things are properly considered, and the experiment made with accuracy, we will be able to discover the motion of the muscular coat of the arteries, to which may be added the observations made by dissections, or otherwise. The resemblance between arteries and the intestinal canal is to be also taken into account. We see fibres in both, paler than these moving the extremities; and any person judging merely from the appearance, would call it the muscular coat. We find in certain places nerves

fent into it. This is proved by the appearances under difeafe, for the exiftence of fpafm muft be allowed in different difeafes. Do not we fee fuch effects in hyfteric perfons, or in the ague? or the effect the paffions of the mind have, or the effect of mechanical irritation upon the glands; not only the quantity of the fecreted liquors is increafed, but their nature is altered by irritation. Laftly, it is proved by the effect of topical ftimuli.

DLXVII.

For the increafed action of the veffels being excited by topical ftimuli, gives a proof of the living power of the arteries. And thus, befides the contractile power, the living power is much more active in the extremities than in the beginning of the arteries; and, could they be equally fubjected to experiment, we fhould find much greater changes produced.

DLXVIII.

The further proof of the mufcular power of the arteries, appears from the diffection of them; the regular courfe of their fibres placed circularly; and from their being provided with nerves, as appears from their fympathy with the other parts of the body. There are many other circumftances which meet together in the fame point. We find, that after the death of animals the arteries are empty of their blood, and the veins diftended with it; and there is no doubt that this would be found to

be the cafe, although the heart were fuddenly cut
out of the body, the arteries would be found
capable of expelling their blood forwards to the
veins.　Befides, feveral circumftances may be
mentioned, as their being actuated in a different
manner in different parts of the body, for th.
arteries have been found to beat more frequently
in one part of the body than in another.　But
independent of this, our proof is full and com-
plete.　Not only the paffions of the mind, but
topical irritation, alters both the quantity and
kind of fecreted liquors.　Irritation produces in-
flammation, as it is applied to the right eye;
and this is not to be explained by fuppofing that
the heart is irritated, and drives the blood for-
wards; for, were that the cafe, the other eye
fhould be equally affected; but the veffels of the
part are thrown into unufual action.

<center>DLXIX.</center>

From the enlargement of the arteries, the re-
fiftance made by their different angles, from their
fize, the extreme fmallnefs of their terminations,
and the infinite number of branches into which
they terminate, &c. the ftroke of the heart is in-
fenfibly loft.　Not but the vis a tergo continues,
and pufhes on the blood into the veins; and its
force reaches farther than is commonly fuppofed.
When we obferve the circulation in a vigorous
and　　we obferve that the blood is pufhed on in

.a uniform ftream ; but when the animal grows lan-
guid, and the blood begins to ftagnate, fo that it
requires a confiderable effort, the ftrokes of the
heart may be numbered by looking at the vein,
and thus the blood is feen mcving on a certain
way.

DLXX.

Befides the vis a tergo, the veins likewife pof-
fefs a living power, independent of their elafticity;
and it would appear that the fmalleft veins, like
the fmaller arteries, poffefs it in the greateft de-
gree. Nay, in the largeft veins, we perceive a
greater alteration made by heat and cold in a
wing than in a dead Lod , owing to chat activity
c their coats, fimilar to what the arteries poffels,
efpecially chat we find many of our veins, parti-
cularly the lacteals, in which ve can ftill lefs de-
monftrate mufcular fibres, are capable of empty-
ing themfelves very completely, independant of a
mechanical external preffure made upon them.
The larger veins are capable of being irritated in
life, of having their coats inflamed and thickened.

DLXXI.

Thus the blood moves in the veins towards the
heart by the vis a tergo, the mufcular power of
the veins, and the preffure made upon them by the
action and fwelling of our mufcles, while other
circumftances may have a lefs confiderable effect.
The motion appears nearly uniform in the veins,

till we come near to the heart; for the motion of
the blood from the heart is broken; and, unlefs
in an extraordinary fituation of the body there
is no ftoppage, becaufe the auricle receives the
blood from the veins during the contraction of the
ventricle, and there are no valves interpofed which
can ftop its courfe, for a very moderate impulfe
is fufficient to diftend the ventricles, which we
are not to look upon as a fpring, but as yielding
to a gentle impulfe, fo that valves were unneceffary.
And, where the refpiration is much impeded, if
there had been valves preffing mechanically upon
the auricles, it might have fent the blood back-
wards into the vena cava, and in this cafe we
do find it preffed backwards, and a pulfation in
the branches, which immediately terminate in the
cava.

DLXXII.

When we compare the force of the blood in
the arteries with its force in the veins, by fixing a
tube in them, we find that the blood rifes ten
times the height in the arteries that it does in the
veins; i. e. it lofes nine tenths of its force in
paffing through the arterial fyftem. Hence one,
and a primary purpofe of the heart, is to renew
the force of the blood; and upon this activity of
the heart the circulation in a great meafure de-
pends. It is in vain to imagine that the blood
runs from the venous fyftem into the heart with

a force sufficient to continue its motion. We see that the heart and brain, by acting upon each other in a circle, have an advantage over every piece of machinery in continuing the motion of the blood with almoſt unimpaired vigour.

DLXXIII.

But there are many other uſes which the circulation of the blood ſerves.

1. The thoracic duct terminates in a large vein near to the heart, and the heart and arteries are perfectly well fitted to mix the chyle with the maſs of blood.

2. The general motion of the chyle through the heart and arteries forms it into blood, all parts contributing their ſhare, ſome more than others, and eſpecially the lungs, occaſion the converſion to be complete, by the appearance of red globules which is acquired from the degree of oxydation that gives them colour, and this appears wherever we compare breathing animals with others, or conſider the effect which air has upon the maſs.

3. The blood thus formed, is preſerved in a proper ſtate of fluidity, and the coagulation in a great meaſure prevented. The exceſs of air, indeed, diſpoſes to the coagulation of the blood, as appears in morbid caſes. Thus a quantity of fluid contained in the cavities of the pleura, when the body is opened, though perfectly fluid, in a few

feconds after expofure to the air will coagulate, which fhews the effect of the air in producing that circumftance; but this does by no means fhow that certain parts of the general mafs cannot be coagulated without that. On the contrary, all anatomifts have found it coagulated in the ventricles of the heart, and we fee it quickly taking place in aneurifm; and after tying a large vein in two places, the blood has been found coagulated in it. In fhort, upon a variety of occafions, we fee the fpontaneous feparation of the blood into its conftituent parts, and find a coagulum of confiderable firmnefs in no great length of time.

4. The circulation conveys the nutritious parts every where, and applies the nourifhment repeatedly; for the parts of the chyle, or of the blood, are hereby repeatedly applied to their proper organs, in order to be feparated from the general mafs. Thus the feparation of the milk depends upon this circumftance; the fame quantity could not be collected without the conftant motion of the blood in a circulation, and in like manner with regard to the other fecretions.

DLXXIV.

There are other purpofes which we fhall afterwards more clearly difcover, while we confider the effect of the glands in certain parts of the circulating fyftem, by which not only a feparation is made, but the liquors are changed at the fame time,

and a difference made between the fecreted liquors and the red blood, in the fame manner as between red blood and the chyle.

DLXXV.

We find many other circumftances depending upon the fame caufe. The growth of new parts is fupplied, and that in a manner that is extremely curious, and which is almoft inexplicable: for, after making an incifion in a part, a circulation can be reftored between the oppofite fides of the incifion; or, if a lofs of fubftance happens in a part, a great number of new veffels are formed. Were we only to confider a formation of arteries, it might not appear fo ftrange; but how do thefe join with veins to return liquors to the heart? the thing certainly happens, that the new arteries meet with new veins that return the blood.

Other phenomena may be fuppofed to depend upon the circulation, but they cannot be fhown to do fo with equal certainty.

DLXXVI.

Abforbent Syftem.

From viewing the arteries as ferving merely for the purpofe of circulation, we now proceed to confider their termination, and the beginning of the veins more particularly; and in doing this we fhall alfo review thofe veins which are univerfally known as the fyftem of the valvular lymphatics. They are generally pellucid, and every where

P 4

crowded, as is found, with valves; fo that in an inch eight pair of thefe valves may be reckoned, and their ftructure is exactly the fame in the human body as that of the valves found in the red veins. There are almoft always two valves together, each defcribing its femicircle, and filling the vein exactly. As it is of very confiderable confequence, not only in phyfiology, but in practice, to underftand their courfe as well as ftructure, they deferve a particular demonftration.

DLXXVII.

We find that they enter into fmall knots, or glands, which have been defcribed, from their fhape, under the name of conglobate glands. When they reach, they divide into a very great number of branches, which are fo minute that it is difficult to force a penetrating injection through them. When we fucceed, we find, that after dividing within the gland, the extremities of the veffels open into cells which are natural to thefe glands, and in which the chyle and lymph are depofited; for, in defcribing them in general, it is all one whether we take the lymphatics come out from the fmall glands beginning equally fmall, and a number of thefe minute branches joining together form the trunk. So we may call the firft of thefe vafa lymphatica ingredientia, and the others, the vafa lymphatica egredientia, fuppofing, always, that a cellular matter is interpofed; juft as when blood is thrown by the arte-

ries of the cellular fubftance of the penis, it
paffes into cells, and from thence into the veins.
Thefe veffels, in their courfe, have numerous
anaftomofes. Thus, two lacteals run a certain
way parallel, each fends off a branch, which are
united to form a third, and each of thefe three is
again fubdivided, and thus we may purfue the
anaftomofes a very great way; and hence no lac-
teal can be readily obftructed, for, if the paffage
is denied to the right hand, the liquor can run to
the left. When the lymphatic reaches a conglo-
bate gland, the whole of it does not enter into
the gland, but it divides upon the furface into
different branches, fome paffing over the gland,
and others entering it; and they communicate
again on the other fide of the gland; and, there-
fore, though the gland fhould be obftructed by
difeafe with an offeous, or rather cretaceous
matter, &c. ftill the lymph can pafs on. When
we follow the lymphatic and lacteal fyftem, we
find one principal or general termination in the
thoracic duct.

DLXXVIII.

In tracing them from the extremities, we per-
ceive two fets, one accompanying the fubcutaneous
veins, the other the arteries and deep feated veins;
and as they run upwards, the deep plexus comes
nearer to the fuperficial. When we trace them
near to the groin, we find the fuperficial plexus

paffing into the inguinal glands, and from thefe
the egredientia entering the trunk behind the ten-
don of the external oblique mufcle, while fome
of the deeper branches are feen entering at the
fide of the pelvis, and repeatedly the fuperficial
veffels communicate with thofe following the
artery, then within the body they enter other
glands. Therefore, we take it for granted, that
the fhewing a conglobate gland is the fame as
fhewing lymphatic veffels; and running up alongft
the loins, they pafs through the glands of the
lumbar plexus, and here they meet with the
lacteal veffels, the lacteal trunk joining with the
lymphatic, and running to the receptaculum chyli.
The thoracic duct, in its courfe, receives the
lymphatics of the trunk; and, where it makes a
turn to open into the internal jugular, there enters
a large lymphatic, which receives the lymph from
the left fide of the head and neck.

DLXXIX.

Thus we have feen that the thoracic duct re-
ceives the lymph from the lower extremities, from
the pelvis and abdomen, with the chyle from the
chylopoetic vifcera, then, in its paffage upwards
through the thorax; it receives the lymph from
the heart and lungs. We find the plexus from
the left arm going through the axilla, and running
towards the thoracic duct with the lymphatics of
the left fide of the head and neck; while thofe of

the right arm, and of the right fide of the head and neck, enter the internal jugular vein of the fame fide, and right fubclavian.

DLXXX.

The general termination of the arteries has been hitherto mentioned in circulating veins, without any regard to the colour or nature of thefe veins; but when we attend to the compofition of the blood, that there are found in it red globules of a confiderable fize, and that the parts compofing the ferum and lymph are invifible to the microfcope, we may fuppofe that fome of the terminations of the arteries, thofe that convey the red globules, are confiderably larger than others which convey the ferum or lymph only; that, as we find the blood, when fet to cool, divides into two parts, a red part and a colourlefs, we might naturally fuppofe, farther, that in the courfe of circulation thefe parts were feparated fomewhat in the fame manner. When we compare with this notion the appearance of colour in different parts of the body, fuch a feparation muft actually take place. We find no red blood within the cartilages, nor any red veffels upon the clear part of the eye, and hence we certainly will admit that there are arteries of a defcending feries; thus there are red arteries, and others to which we may apply the name of ferous or lymphatic. When we ufe the term lymphatic, we do not mean that the

coagulable lymph, unmixed, paſſes through theſe, but that this is conveyed by a certain portion of the ſerum; but we can even ſuppoſe the ſerocity ſeparated from the lymphatic part, and again pure water taken in by drink, ſeparated from both; and it is beyond all doubt, that there are ſerous as well as red arteries.

DLXXXI.

Beſides thoſe performing circulation, we all know that many parts are ſeparated from the blood; that there are ſecerning veſſels, that make a ſeparation either of what is hurtful to the body, were it to remain longer in the courſe of circulation, or what may be uſeful in various reſpects, as milk to nouriſh the child, or bile and other liquors that are afterwards to be employed for uſeful purpoſes, for the preparation of our aliment.

DLXXXII.

The ſecretion may be made in a very ſimple, or in a very complex way, and that varying in different parts of the body. For, whilſt we uſe the term of ſecerning arteries, we would be underſtood to mean that, whilſt the arteries make a ſeparation, they at the ſame time alter the liquors that paſs through them.

DLXXXIII.

Authors generally imagine that the liquors which are little changed, perhaps ſcarcely at all changed,

merely water are fecreted from what is called an
exhalant artery; but of late years, fome authors
of eminence have taken the fancy of denying that
there are exhalant arteries, and would perfuade us
that, were we not to obferve a glandular mafs,
the fecretion is performed through inorganic pores.
But this is improbable and inconfiftent with ana-
tomical facts on the different parts of our body,
as on the inner fide of our lungs, and of the
alimentary canal, we find glands for the feparation
of flime or mucus; but, befides this, there is a
fecretion of matter which poffeffes very fingular
powers and properties, which is depofited into
the trachea, and impregnated with a remarkably
poifonous quality. The matter fecerned into the
cavity of the ftomach and inteftines, poffeffes fin-
gular properties in diffolving our aliment: can we
imagine that fuch variety is made by an exudation
through inorganic powers? Are not we rather to
fuppofe that the ftructure is organic, and highly
curious, through which fuch liquors can be pro-
duced. If we pufh an injection a little, we per-
ceive regular terminations of thefe veffels into
cavities which can be plainly demonftrated. And
we obferve that even the quality of thefe fecreted
liquors can be varied and modified by irritation.
Thus, upon the furface for inftance, the fecretion
is affected in various difeafes by fpafms. There-
fore, though the notion of exhalant arteries has

rather been taken for granted, than proved by fyftematic writers, the more we confider the matter we fhall the more readily adopt the idea. Generally there is a knot or gland interpofed, into which we trace the termination of arteries, as in the feparation of the bile, &c.

DLXXXIV.

From the facts thus ftated, there can be no doubt that the red arteries divide into coloured and colourlefs branches, that many of the colourlefs branches ferve for the purpofe of fecretion or excretion, or that we find exhalant arteries fent off. In other cafes, a number of arteries collected, by their complication form a knot or gland, from which we find a duct fent out, while others of the colourlefs branches, with the red extremities of the arteries, perform the circulation. Thus we cannot doubt that the cornea of the eye has a circulation through it nearly in the fame manner, as that performed in the other coats.

DLXXXV.

But it remains that we determine the courfe thefe fluids afterwards take to return to the heart. There muft be circulating veins correfponding to the red and lymphatic arteries, and there muft be abforbent veins that fuck fluids in, correfponding to the exhalant and fecerning arteries, and befides, ferving a variety of other purpofes. Thus the moifture is taken in from the air, and we all .

know that medicines can be taken in as mercury, the ointment rubbed on the furface having the fame effect as when fwallowed, and the chyle is taken up from the alimentary canal.

DLXXXVI.

Thus there are two kinds of veins, the red veins and the valvular lymphatic veins; in what manner are we to fuppofe them formed?

DLXXXVII.

That the red arteries terminate with the red veins, is beyond all manner of doubt; but how are we to fend back the liquor contained in the lymphatic arteries, or fucked in from the different cavities? Are we to fuppofe with fyftematic writers that the lymphatic arteries from the valvular lymphatic veins pafs through the glands, and that the abforbent veins pafs into the red veins? Or are we to conceive that the red arteries form the red veins, and the lymphatic arteries form the lymphatic veins, and that the abforbent veffels which are colourlefs, terminate in the colourlefs veins; the valvular lymphatic, fuppofing the red part of the blood to go by the red veins, and the abforbent liquors by both.

DLXXXVIII.

Or is there not another fuppofition ftill much more probable, a fyftem that is much more fimple, viz. As an artery in its extremities divides into red and colourlefs branches, would we not fup-

pofe that the red veins, in like manner, are formed
of coloured and colourlefs branches, and that both
join together to form the red veins, and that they
thus correfpond with the arteries in one of their
principal offices, of carrying on the circulation,
and in that only whilft the valvular lymphatic
veins correfpond with them in fo far as they per-
form fecretion, or that they receive all the liquors
that are any where effufed, fo that the circulation
is carried on by the red veins, and abforption by
the valvular lymphatic veins ; and that thefe have
open mouths beginning from the furface, and from
all the cavities of the body, fo that the fluids do
not pafs directly into them by the force of the
heart.

DLXXXIX.

In order to fix a proper opinion, it is neceffary
to ftate facts and experiments, as well as argu-
ments from the nature of things, to eftablifh fome
fixed opinion; and the firft thing in doing this is
to fhew that authors have, not as they fuppofe,
given an abfolute and direct proof that the val-
vular lymphatic veffels proceed from the arteries.
The arguments ufed for this purpofe, though at
firft fight plaufible, and feemingly conclufive,
when properly examined, are founded in error.

DXC.

As we obferve the blood out of the body to
divide into a red and colourlefs part ; and, as we

find in the body coloured and colourlefs veins, there can be little doubt that each of the veins correfponds to the parts of the different colours; but furely this obfervation touches not the origin of the veins. Nothing is thence concluded with regard to that. From there being in the body parts that are colourlefs, we may conclude that the arteries divide into coloured and colourlefs branches; or we get a proof that there are more arteries than we perceive with the microfcope, the colourlefs branches efcaping us from their fmallnefs and the want of globules; fo that we have no manner of judging.

DXCI.

The next argument is more direct. We have been told, by a fucceffion of anatomifts, and told truly, that when an injection is thrown with violence into an artery, the injected matter is found to fill the valvular lymphatic veins. But feveral circumftances have been overlooked by the chief peifons who have made thofe experiments. There was a laceration of the tender branches of the artery, an effufion into the cellular fubftance, and a laceration of the branches of the lymphatic veffels; and the mercury had entered at the lacerated places, which often happens, and without laceration it never fucceeds; but if we fill the veins at the fame time with the arteries, we feldom remark any of the

lymphatics filled; whereas, upon pushing an injection suddenly, the materials not of the most penetrating kind, we shall have the lymphatics injected, and not a drop in the veins; and in many preparations formed of the testicle, many of the lymphatics are filled, some of them very small. The valves prevent the filling them by their trunks, and none of the blood vessels have the matter injected into them; and the manner of injecting them is to bruise the same substance, to pour the mercury into a hole, and to work it into the several branches of the lymphatics: so we do not find any proof, from these experiments, that the lymphatics are continued from the blood vessels, which is all the use that we can make of such experiments; for it is not meant to hint that the mercury passed in at the most minute mouths of the lymphatics.

DXCII.

There is another argument of considerable weight; that the lymph is sometimes found coloured with the red part of the blood. This observation likewise is just, and what is seen repeatedly in living animals; nay, constantly, it is the case wherever, by a wound made upon a living animal, the blood is effused, or the finer parts of it, a bloody water, whether in the cellular substance or larger cavities of the body, but more especially if by the wound sensible parts have been.

expofed to the air, fo as to become inflamed; and
it matters not which of the bowels are expofed
to produce this effect of tinging the lymph red.
Now, what reafon is there for fuch an appearance?
are we to imagine that where the red colour is
found, where perhaps red globules are found in
the lymphatic veffels, that the whole arterial fyftem
has been dilated fo as to allow thefe to pafs? Only
attend to fome of the inftances; there was nothing
before hand to produce the dilatation, which muft
have taken fome time.   In the appearances which
follow every inflammation, a bloody matter is
effufed into the cellular fubftance, and this cir-
cumftance was not attended to by thofe who draw
the conclufions that the red colour fhowed the
continuation of veffels; and they overlooked this
circumftance, that the red globules break down
into invifible parts; fo they are perhaps as capable
of being abforbed by the found mouths of the
lymphatics as any of the other parts.   Nay, more
readily perhaps; becaufe where the whole mafs is
effufed, the red colour difappears before the yellow.
Inftead, therefore, of this obfervation proving a
continuation of the valvular lymphatic veffels with
the arteries, it rather feems to fhow the contrary,
that the lymphatics begin by open mouths from
thefe cells, into which, in cafes of inflammation
and wounds, the red particles are effufed.

DXCIII.

No proof, therefore, is afforded of the colour-less arteries terminating in the lymphatic veins; but do we find any that the colourless arteries do not terminate in red veins? Every circumstance leads to the supposition that they do. This we we find founded first on the analogy of arteries.

DXCIV.

An artery, at its termination, consists of co-loured and colourless branches. Why should we not suppose a vein at its beginning to consist of the same? It must be admitted, that nature forms no more of the colourless part of the blood than is proper for the purposes of life, for main-taining the diffussion and separation of the red globules from each other, and for many other uses. Now, if these parts be necessary where the fluidity is preserved by the greater agitation of the heart and arteries, they are certainly more so where the circulation is more languid; and, there-fore, after the necessary secretions are made, the remainder should return to be added again to the red globules. Hence, instead of imagining that this part is carried away from the red veins, we must suppose that after the colourless arteries have made their disperfion through a colourless organ, they run into red veins. Thus in the eye of a child we find arteries conveying red blood, which afterwards become too small to admit the

globules, yet the termination of thefe arteries muft ftill be in the red veins; and, when we view the different places of animals in which the lymphatic fyftem is found, and where there is a·greater proportion of colourlefs· fluid, as in a fkate, the flefh is of a white colour, fo that the arteries muft exclude the red globules. If the colourlefs veins terminated in the lymphatic fyftem, we would find the lymphatics of a prodigious number and fize, and the vena cava receiving only the red globules very fmall in proportion to the aorta, but the proportions are the fame as in man. We may therefore apply what we obferve in thefe fifhes to ourfelves, and take it for granted, that the red veins correfpond to the red arteries fo far as concerns the circulation of the blood; and if it is proved that the red veins receive all the circulation of the arteries, we leave abforption only as the office of the lymphatic fyftem, and we have direct proofs to fhow that the valvular lymphatic veffels begin by open mouths at the feveral cavities, and fuck in at their· extremities the liquors they convey. The analogy of the lacteal veffels fhow this; we find the fame ftructure of their coats, which are thin, tough, and tranfparent; we find them both crowded with valves; we find them both paffing through glands, which agree perfectly, whether we confider the fhape, colour, and confiftence, or the injected veffels. Thus the mefenteric glands, and

the conglobate glands of the groin and axilla, per-
fectly agree in every circumstance. We find the
veffels in a fimilar way paffing along the furface
and paffing through them; and to carry on the
analogy they unite together, fo that the thoracic
duct is the common cava of both fyftems. What
we obferve then of their ftructure and courfe,
would lead to fuppofe that they agreed as to the
manner of their origin, that the lymphatic veffels
begin in the other parts of the body by open
mouths, whether on the furface, or from the dif-
ferent parts of the cellular fubftance, or from the
feveral cavities of the thorax, abdomen, joints,
head, and univerfally. Or let us make the com-
parifon with the red veins. If the lymphatics and
red veins had a fimilar origin, we fhould probably
find the valves difpofed nearly in the fame manner.
We find valves in the red veins only where there
are mufcles, becaufe their fingle purpofe is to
direct the blood to the heart, and thefe valves are
conceived as dividing the veffels into a number of
parts, and leffening the preffure of the blood upon
the defcending veins; but they have not this effect,
for if the blood is juft now ftagnating in the veins,
and a motion is made, the confequence is, that
the valves are all opened, and the preffure is the
fame upon the bottom as if the valves had been
entire. The preffure is not leffened becaufe the
liquor is in motion, but increafed; and it matters

not whether the veins afcend or defcend to the heart; the only circumftance that requires valves is their paffing along mufcles; fo we find them in the fuperior parts, in the head, &c. but fcarcely within the cavities. But, in the lymphatic veffels, the valves are found every where, and we obferve the effect of this is, that the flighteft preffure upon them drives the fluids outwards beyond the next fet of valves towards the heart. Thus, if we inject a lymphatic veffel with mercury, we muft be cautious how we touch it, for it readily goes onwards, and we cannot again fill the interftices between the valves that the mercury has left; thus they are fitted to take advantage of the flighteft preffure or impulfe; every ftroke of an artery paffing over them ferves to drive the blood onwards. Hence, univerfally, the lymphatic fyftem is crowded with valves, fhowing that it wants the fame preffure onwards, or the vis a tergo which is found in the other veins; fo that as they are fitted to take the advantage of every preffure, they need it to promote their contents.

DXCV.

After an artery is tied up, and the flow from the heart intercepted, the lymphatic continues to be filled. Why? Becaufe it is independent of the artery; and whilft the life, the warmth, fenfibility and contraction of the heart continues, the motion in the lymphatic continues, though the

vis a tergo
heart is cut ·

open, if you empty any veffel by preffure upon it
with the finger, it foon fills again, after the motion
has ceafed in a remarkable degree in the red veins.
The fame thing appears from the colour and
appearance of their contents. Thus, in jaundice
occafioned by a total obftruction of the biliary
ducts, the lymphatic veffels take up the bile
almoft as pure and bitter as it is found in the
gall bladder, which is a direct proof that the lym-
phatic veffels in the liver begin from the cavity of
the biliary ducts, viz. perform abforption, and fo
far as proof is neceffary this may be fufficient.

DXCVI.

But there are other circumftances which it is
very material and ufeful in practice to attend to.
Where acrid matter, whether of medicine or dif-
eafe, is applied to our body externally or inter-
nally, we find, in many inftances, that the matter
directly enters the lymphatic veffels, and, before
it fhews its influence on the body in general, pro-
duces fwellings of the glands, through which the
lymph, loaded with medicine or other matter,
naturally paffes. Thus it often happens, that
blifters produce fwellings in the conglobate glands,
not in thofe next which the blifter is applied, or
thofe immediately under it; but in thofe fo fitu-
ated as to receive the lymphatic veffels from the

part blistered, however distant, as in the axilla, or inguinal glands, when the blister was applied to the hands and feet, and that without any pains spreading along the member; and surgeons often find that blisters of the head produce wax kernels of the neck, their situation varying according to that of the blister. The same is observable in diseases, as in the plague, perhaps; but, beyond all doubt, in the measles, small pox, cancer, and lues venerea.

DXCVII.

This is a clear evidence that the valvular lymphatic vessels are absorbents, performing that office; and they do so universally, because every part of the body, in a diseased state, can produce such swellings. And the idea of some, that lymphatics are wanting in the brain and some other parts, because anatomists have not yet injected them, merits a serious refutation. Are we to suppose an exception of one organ from the general analogy of all others? That the whole order, not only of absorption, but of circulation, is inverted? The only reason assigned is the difficulty of seeing them. We can bring them into view in the abdominal viscera, but we cannot do this in the brain when the animal is in life. In the brain they terminate in a different manner from what they do in the other parts. There is somewhat particular in the course of the larger vessels, in that

they do not accompany the arteries; but we find a number of conglobate glands immediately under the brain, in proportion greater than could be supposed, unless the lymphatics of the brain passed through them; and wounds and suppurations of the brain have brought on swellings of the neck.

DXCVIII.

But, supposing that the lymphatic system does perform absorption, does it follow that the absorbents do not likewise terminate in the red vessels; or that absorption is not performed by those also; or while the valvular lymphatic veins absorb, are we to suppose that the red veins assist in the same office? It is not consistent with the simplicity of nature to make such a supposition, to suppose one set of veins serving the simple purpose of absorption; and that the other set of veins shall not only serve that, but likewise the purpose of circulation. It is more probable, that as the two kinds of veins correspond to different kinds of arteries, that they correspond entirely, and that the one office has no connection with the other; but that the red veins serve for circulation, and the lymphatics for absorption.

DXCIX.

If the structure had been fully understood before the other suppositions had been formed, we might have allowed it to have had more weight; but the red veins were known long before the

lymphatics, and therefore were for many ages supposed to serve every purpose in the body; and even after the discovery of the circulation, they took it for granted, that the red veins served both for motion and absorption. And it was not easy for physiologists, though they now began to treat matters more minutely, to divest themselves of their prejudices; and instead of producing arguments against the former opinion, more were advanced in favour of it.

DC.

Thus it has been alleged, that the lymphatic vessels are wanting in a variety of animals, which in other respects agree with man; so that absorption must be performed in them by the red veins. But we find that in the oviparous animals there are lymphatic vessels.

DCI.

There has been also alleged the want of lymphatic veins in certain places, because they have not been seen, as in the brain and eye, and it has also been appealed to injections. An injection is made into a vein, and it is found that some cavity is filled, and truly water squirted back in the mesenteric vein will be effused; but it may have entered the artery, and passed by its exhalant branches. And reversing the experiment, let us pour the water into the cavity of the intestines, and see if it enters the vein; and if we use coloured sub-

ftances, or thofe that have a ftrong fmell, and which readily enter the lymphatics, we find that they do not enter the mefenteric veins.

DCII.

Wherever, alfo, a number of the glands have been obftructed, as in the axilla, the whole arm has become œdematous, and yet the red veins are not affected; and if thefe are provided with numerous abforbent veffels, why do not thefe perform their office?

DCIII.

Having then endeavoured to determine the nature of the abforbent veffels, let us next confider the way in which we are to conceive liquor to move in a veffel that wants the vis a tergo that is not continued from an artery. The lacteals fuck in their contents, or draw it in, in the manner which the veffels of vegetables probably do, or in the manner in which very fmall tubes draw water from a ciftern, and the liquor only enters at all if it be of a mild nature; and hence we learn that our lacteals poffefs a living power, that they fhut their mouths againft acrid matter; fo they poffefs motion and contraction to fuch a degree as to exclude a very thin fubftance altogether, providing it is extremely acrid. This helps us to explain the progrefs of the liquor; for, although the water will afcend in the tube a certain way, yet at length it flops; fo the attraction of capillary tubes only

begins a motion, it is not capable of continuing it,
rifing only to a certain height, and then ftagnating.
To puſh it on a living power is neceſſary; and this
beyond all doubt is inherent in the lacteal or
lymphatic, from its own coats. And, as a farther
proof of its being mufcular, after the death of an
animal, when the lacteal veſſels are full, after
cutting off the head or heart they empty them-
felves completely, and puſh on all their contents
into the thoracic duct, fo that it is feldom that we
can give a demonſtration of the lacteal veſſels
from the colour of their contents. From that it
may be prefumed that our veins poſſefs a fimilar
power, and chiefly in their fmall branches. But
befides the power inherent in them, they receive
a confiderable affiſtance from the preſſure of the
neighbouring or external parts; and in the intef-
tines it is beyond doubt, that the mufcular coat of
the inteſtines alternately contracting and puſhing
on the fœces, affects the beginning of the lacteal
veins; and when the lacteal itſelf contracts, the
valves hinder the liquor from being preſſed out-
wards, fo that every preſſure determines the fluid
to the heart, as the pulfation of the arteries and
the action of the mufcles. Thus, when a vein is
opened by acting with the mufcles of the arm,
we accelerate the flow of the blood, and we would
do fo though there are no more veins in the
member, and the lymphatic veſſels appear to be

purpofely expofed to the action of the arteries, and even fwelling of the common red veins, while from their being crowded with valves, they are fitted for taking advantage of the flighteft preffure; and the principal trunk of all runs up the thorax parallel to the aorta, fo that every ftroke of the heart affects it, and pufhes forwards the chyle with confiderable violence: fo we can readily underftand the manner in which the liquor enters the abforbent veffels, and is conveyed to the heart.

DCIV.

The principal offices, then, of the abforbent fyftem, or the general purpofes that it ferves in our body, are various; and the very firft one that occurs to us refpects the lacteal veffels, that they ferve for taking in our nourifhment; and what we fay of the lacteal veffels even in this view, feems in fome meafure to apply to the lymphatics. It alfo prevents the too great accumulation of liquors in the various cavities of the body, unlefs there was a correfponding abforption to the exhalation into them, every fhut fac would foon become dropfical; and, although this was not the cafe, although they did not fupply more than is neceffary to make a free motion, yet the liquor by remaining long would become acrid and hurtful, hence the neceffity of a conftant change; and all the fecreted liquors undergo it; as perfons grow fat and lean, fo the abforbents

can take up from the adipofe follicles the fat of
the body, and there is a continual change of the
fatty parts, and of all others in the fame manner.

DCV.

We muſt alfo fuppofe that many changes are
operated on the fecreted liquors, in order to fit
them for their feveral purpofes, for we cannot
imagine that they come from the arteries with
all their properties. Thus, the bile in the gall
bladder is much thicker, and materially different
from the bile found in the hepatic duct; fo it has
undergone a preparation, particularly the abforp-
tion of the thinner parts. In like manner the fat
is feparated from the exhalant veffels, not of the
fame confiſtence as it is found in the adipofe
plexus, a watery fluid muſt have conveyed it there,
which is afterwards re-affumed. So in the mucus
that is expofed to the air, we find a febaceous or
mucous matter in the follicles or bags of the
trachea, &c. and this mucus has been alfo changed
by abforption. Perhaps we may puſh this one
ſtep farther, that the abforbent veffels do not
merely ferve for the preparation of the fecreted
liquor, but that a fomewhat that is ufeful to the
œconomy is at the fame time taken away and re-
turned to the mafs of blood; viz. that by the
fecretion fuch changes are produced upon the
liquors, that when thefe are re-affumed, they have
different effects upon the body from the effects

of the principles of the blood. Thus it can be
rendered probable that in the jaundice, the yellow-
nefs is not owing to the want of feparation of the
bile, but to its being returned to the blood; and
if we   the return, we can prevent the
difeafe. In the femen, alfo, we obferve that the
whole conflitution is affected by it; if this was
owing to a want of feparation, the fœtor obferved
in the flefh of bulls would be more remarkable in
the flefh of oxen.

DCVI.

Perhaps it may be afferted that fomewhat ufeful
is taken in from the moft excrementitious liquors,
as the urine; for in fifhes there is a vefica urinaria.
If all the parts were ufelefs, it might be difcharged
from the body by the ureters without any incon-
venience to the animal.

DCVII.

We obferve in the laft place, that the lymphatic
fyftem is connected with the lacteal, or rather
that the veffels defcribed under two names make
one fyftem, and the lymph is mixed with the chyle.
Indeed, without this dilution and feparation, the
mixture with the mafs might have proved hurtful.

DCVIII.

Thus, by this doctrine concerning the lymphatic
fyftem, a variety of circumftances are explained.
Our views are enlarged by confidering the ab-
forbent veffels as valvular, for we fee more dif-

tinctly the benefit in health, and in difeafe arifing
from friction and exercife; whilst the branches of
the red veins were confidered to perform the
office this is lefs evident; but from the number of
valves we cannot rub the body, but we accelerate
in a remarkable degree the flow of the lymph,
and that will lead to the ufe of this in a variety of
difeafes, as in the dropfy, where we are very apt
to err in recommending reft and a horizontal
pofture, which leffens the fwellings of the feet,
becaufe the erect pofture increafes exhalation,
and makes the return more difficult; but exercife
and friction are of particular ufe.

DCIX.

As the veffels pafs through glands before they
reach the heart, we find in thofe a minute divi-
fion of the veffels, and then an opening into very
fmall cells, in which the liquor for fome little
time has its motion diminifhed, is more out of
the courfe of circulation. Hence we conceive
that the glands of the lacteals and lymphatic
fyftem are much expofed to obftruction, and that
this will more readily happen in the lacteal glands,
becaufe a greater quantity of acrid matter paffes
through them.

DCX.

By this divifion of the lacteal veffels in the
glands, the reafon appears why, after the break-
ing of buboes or fcrophulous tumours, there is a

confiderable difcharge of watery matter, the flow
of lymph into the gland continuing, which in
thefe cafes does not readily enter the vafa egre-
dientia.

DCXI.

By the anaftomofis of the lymphatic veffels and
lictcals every where, the fmall branches con-
tinually receive an addition from the neighbour-
ing ones; and whilft many pafs through the
gland, others pafs upon the furface, and therefore
an obftruction may happen in the fift lymphatic
glands which a poifonous matter touches upon;
but although the fame poifon be conveyed further,
the glands near to the heart are not affected.
Thus, with regard to the venereal bubo in the
groin, the formation is fimilar. Not one within the
body is met with, which is prevented not merely
from the warmth of the part, but efpecially from
the poifon being diluted by the joining of the
lymphatic branches from the inferior extremities,
before the poifon reaches the next glands. Keep-
ing the fame in view, the reafon is afforded, why
a ftoppage in a fingle gland does not produce
anædema in the veffels from which it is originally
derived, a number of the veffels pafling over the
gland, and carrying on the abforbed fluid towards
the heart.

DCXII.

From attending to the caufe of the fwelling of

thofe glands, a direction is offered in the cure; for, by knowing the caufe of the venereal bubo, we endeavour to direct the mercury into the gland, by applying it as near as poffible into the part receiving the contagion.

DCXIII.

In the fame way we are able to determine the extent of the difeafe in cancer, by the fwelling of the contiguous glands; to judge of the fuperior advantage of the inoculation in fmall pox, from the poifon entering through the external parts.

DCXIV.

Structure of the Glands.

But, on leaving the vafcular ftructure, it remains to examine more particularly the nature of the glands; and, by tracing the beginnings of the feveral ducts, to endeavour to determine whether the arteries communicate with thefe exactly in the fame manner that they communicate with the circulating veins; and thus, that their ducts only differ from veins in this refpect, that the end of the duct does not terminate in the heart, and that the liquor differs from the general mafs; or, whether a receptacle bag, or follicle, be interpofed. Are we to imagine that a branch, which excludes red globules, takes its rife from the artery, and terminates in an excretory duct, or that there is a bag or follicle interpofed, into which the artery pours the liquor.

DCXV.

Thefe are the two common opinions enter-tained by phyfiologifts. The moft antient fup-pofes, that in every excretory duct, at the beginning, there is a follicle; and, in proof of this, it is ob-ferved, that there are bags containing flime upon the tongue and in the firft paffages, and a hole in the fide of it. In the amygdalæ there are alfo feveral holes which lead to bags of confiderable fize. Hence the amygdalæ have been compared to a collection of fmall bags, and the liver and the falivary glands have been fuppofed to be com-pofed of a number of knots, in each of which there is a bag of the fame kind; but from the vaft number collected, there feems a neceffity that thofe fhould not terminate by holes, but there muft be long ducts, like the hepatic duct, to convey the liquor. And in morbid bodies, alfo, veficles are found in the liver, and alfo within the kidneys; and thofe are alleged to contain urine. So it has been conceived, that fome one of the follicles of the kidney had been obftructed, and had enlarged, thefe veficles fhewing the real ftructure, only in a greater fize.

DCXVI.

When the art of injecting was improved, it was pretended that it was unfafe to reafon in that manner from the analogy of one organ to that of another; and that, by injection, all the glands

could be changed into veffels, without leaving any appearance of follicles. It was alleged, that in the kidney the circulation might be imitated, and a coloured liquor made to pafs into the pelvis; and yet, upon examining the kidney, no bags could be feen; or that, by injecting the renal artery, the tubulus uriniferus may be filled without any follicle found. A calculation is entered into, that, in the cafe of follicles, there would be an almoft total ftagnation of the fluids in the paffage; that the velocity of the blood would not be 1,200,000 part in one of the follicles that it is in one of the arteries that is fuppofed to make the fecretion. From this it has been inferred, that the glands are merely compofed of cylindrical veffels.

DCXVII.

But to fix thefe points, we fhall be more particular in our inveftigation of the glandular organs. Beginning with the fatty bags, we obferve with the microfcope, that the whole fat of animals, not only the marrow, which was fuppofed to confift of round fatty bags, but the fat is all divided into bags of a minute fhape, painted with veffels, fo that bags or follicles in that glandular organ are indifputable. Befides, all anatomifts admit of follicles where the air, or fharp liquors are applied, and a defence is needed, as in all the mucous and lymphatic organs. In thefe follicles the mucus acquires its proper vifcidity, or other properties;

fo the whole of the tongue is made red with an injection, and the bags of the follicles give it this rednefs, numerous arteries running upon them; and in the paffage for the urine we find bags of a confiderable fize. In our throat, round bags anfwer as well as any other fhape; but in the urethra they are oblong, and thereby the liquor is better pufhed out at its extremity before the urine comes in contact with it.

DCXVIII.

Next, in the organs of generation, particularly in the ovarium, we perceive a round veficle filled with a liquor, no doubt of the higheft importance. This veficle opens at the time of conception, and it is painted with veffels, and we find in the male long tubes forming the tefticle, that the femen is depofited into thefe, and the communication of the arteries with the turns of the feminal ducts may be compared to the communications between the arteries and ducts of the inteftines.

DCXIX.

With regard to the more compound glands, the ftructure of them is more like to the fhape of a bunch of grapes or currants. All the ducts begin from bags. We fee with the naked eye this ftructure in the mamma. We likewife obferve little lobules compofed of cells on the furface of : lungs; and in the falivary organs, we know as tainly as with regard to the lungs, that the.

faliva is depofited into cells. When the falivary
gland is properly injected, and expofed to the
microfcope, the appearance is nearly the fame
which the furface of the lungs has when expofed
to the naked eye, and every one of the little
lobules are diftinct from one another. The join-
ing, however, of the receptacle with the duct, is
very ftraight, and it is difficult to fill the re-
ceptacles of the faliva with mercury, generally the
duct will burft before the mercury diftends the
receptacle. With melted wax, which is a more
penetrating fubftance, we can fill them more
readily. In the parotid gland we find fome little
difference in the fize of the receptacle, and in the
manner of communication. In the pancreas, the
ftructure is more complex, and perhaps the faliva
is not the fame; but as there is fome difference
of ftructure, the particular texture may be of
greater confequence than we are aware of.

DCXX.

Next, with regard to the liver, the divifions
are fo minute in this organ, that it is next to im-
poffible to determine the firft beginning of the
biliary ducts, becaufe the lobules are very much
intermixed. But as we have it in our power to
dilate the ducts, we fee that the biliary ducts
begin likewife from very minute bags, fuch as the
naked eye does no ways take in. But fuppofe
they equal the thoufand part of an inch, ftill they

are large, compared with the arteries making the
fecretion; for three or four thoufand arteries
conveying red globules could be laid in the
fpace of an inch, but an artery circulating red
blood is larger than one making the fecretion,
fuppofe four times, fo that the diameter of the
fecreting branches is to the veficle as one to
twenty. And it is eafier to pafs an injection
from the vena portarum into the biliary duct, than
the other way.

DCXXI.

With regard to the kidney, the courfe of the
fluids may be feen through it into the pelvis; but
the more we are ufed with microfcopical obferva-
tions, we fee the more difficulty in determining
it exactly.

DCXXII.

Thus it is very evident that all, or almoft all,
the glandular organs have receptacles interfperfed
between the arteries making the fecretion and
the excretory ducts.

DCXXIII.

But although we can trace the ftructure of
glands back from the excretory duct to the fol-
licle, we are by no means able to give an account
of the changes that are operating; and even did
we know the way in which the arteries commu-
nicate with the follicle, we will be ftill far from
underftanding the changes made upon our blood

by the glands. Thus, we can trace the whole course of the red globules of the blood, and yet we cannot fee how thefe are formed from the food. It is effected by the general circulation; but with regard to the particular manner, we certainly do not comprehend it.

DCXXIV.

In fpeaking of fecretion, we muft include a variety of circumftances; and, perhaps, after enumerating all that occur to us, others ftill remain, the effects of which efcape us. We fee that the arteries of the glands are placed in very different fituations with refpect to diftance from the heart, and the direction varies greatly; fome going off at acute, others at right angles. There is, befides, a great difproportion in the fize of the arteries compared with the organs on which they terminate, in their length, &c. We cannot but fuppofe that thofe various circumftances have great effect. The coats of the arteries are alfo of different thicknefs. In the liver, the fecretion is made from blood that has undergone a circulation, and the force of which is more broken than in any other part of our body; fo that long before blood comes near to a gland, or to the ultimate termination, a proper preparation is made for the fecretion. Befides the effect of the different angles, we muft alfo fuppofe the activity of the veffels to have effect; we obferve that irri-

tation varies the quantity, and even the nature
of the glandular liquors; and we are not,
with authors, to conceive mechanical changes,
as that the glands reprefent fieves, that the fecre-
tion and changes depend upon the ultimate ter-
minations of the veffels. There are alfo chemical
ones going on from the firft origin of the branches,
as well as in the termination of the arteries in
the follicles. By fermentation, we know that
the fame fubftance puts on a different nature, and
fome fimilar changes take place in the glands.
Therefore, though we were able to trace the
arteries from their beginning to their termination
in the ducts, of the glands, we fhould be unable
to explain the changes we obferve. We can go
fo far, but there is a limit beyond which we can-
not pafs.

DCXXV.
Nervous Syfiem.

We next proceed to confider the general office
of the nervous fyftem. In beginning which it
is neceffary to give fome general idea of the
manner in which fome of the more powerful
medicines act upon the body of animals; viz.
whether they affect them through the nerves only
of the part to which the medicine is applied, or
whether they operate by entering firft the ab-
forbent, and afterwards the circulating fyftem?
We are, indeed, varioufly affected by medicines,

ī by the matter of difeafe acting upon our body;
for, befides topical medicines, which fcarcely af-
fect the parts at a diftance, medicines by refting
merely upon a fingle nerve, through the nerves
alone can affect the whole fyftem, or from being
circulated they may have this effect, and chiefly
upon the nerves of the circulating fyftem. Farther,
we find that fome medicines have a topical de-
termination, or one organ is more affected by
them than another; all the reft of the fyftem,
however, though not primarily, comes to be af-
fected, re-acting on the reft. Thus, fuppofe mer-
cury to enter the heart and veffels; they feel its
influence, the pulfe is affected before it fixes upon
any organ, and the venereal poifon is killed float-
ing in the general mafs; but in confequence of
its attacking a particular organ, all the reft may
come to fympathize : fo the operation of medicines
fermenting and multiplying in the mafs, may be
more complex than is generally apprehended.

DCXXVI.

With thofe facts we are better able to judge of
the nature of the nerves. The manner of their
origin and courfe is already known. A nerve
is the production of the medullary fubftance
of the brain, covered nearly with the fame coats
as the brain ; an inner vafcular one, refembling the
pia mater; and an outer fheath, either the fame
altogether, or very like to the dura mater. This

is found in every part without the head : with the
exception of ganglia, the threads of the nerves
are laid parallel to each other. By diffection, a
very minute divifion of the nerves is feen into
threads; but applying the microfcope, that divi-
fion is carried on as far as our fenfes go, efpe-
cially if we truft to the obfervation of Lewenhock,
almoft *ad infinitum.* Hence we are led to con-
fider whether the nerves are to be looked upon as
folid chords, like wires, acting by tremor; or
are we to fuppofe that they are hollow tubes con-
veying a fluid within them? Or, are we to
imagine, perhaps, that whilft they convey a fluid
within, they in fome other manner unknown
conduct fome other fluid that is ftill more fub-
tile. But, perhaps, with regard to thefe feveral
points, we can only form fome very general con-
jectures, without being at all able to determine
ourfelves.

DCXXVII.

The moft common opinion rejects the idea of
folid chords acting merely by vibration, and there
are many circumftances which concur againft this
notion. We have feen that the nerves are ex-
tremely fhort at their origin ; if they appear hard
in their progrefs, that depends evidently upon
their coats. Again, when they come to operate,
as in the eye or ear, we perceive that the coats
are laid afide ; nay, if the nerve is not to be fub-

ject to motion or preffure, as the portio mollis of
the auditory nerve, the firm coats are altogether
wanting; and we find fo many nerves inclofed in
the fame bundle, that we fcarcely have any idea of
tremor communicated to one without communi-
cating it to others; we find no determined pro-
portional length and tenfion; on the contrary,
tenfion is avoided, branches are tied down, pre-
venting the regular tremor; and what is ftronger
than all this, fuch an idea is repugnant to the
general analogy of animal bodies.   Wherever we
perceive fluids circulated, and chords fent out,
thefe are tubular; and we obferve that the moft
minute thread, the fmalleft nerve taken from one
animal, and tied around the nerve of another, fo
as to comprefs it, altogether interrupts its influence:
fo there is little probability that the nerves, if folid
chords, operate by tremor.

DCXXVIII.

On the contrary, there feems to be a great
degree of probability, but no abfolute certainty,
that they convey a fluid.   We can determine
nothing from looking at the cut end of a nerve;
we can give no credit to thofe who pretend to
have feen a fluid diftilling from a nerve, nor are
we to reject the idea, becaufe it cannot be feen,
fince the nerves divide into parts fo minute and
colourlefs, that if they contained a fluid, we
could not render that an object of fenfe.   We

might as well deny fluids in the body of a mite, becaufe before a microfcope we do not fee the motion of thofe; and the nerves of the eye, for inftance, divide into parts exceedingly minute, far beyond what we could conceive, till we made a calculation, which we can make with tolerable accuracy. If the head of a pin can be diftinguifhed at the diftance of twelve feet, the diameter of the figure upon the retina is as much fmaller than the head of the pin, as the diftance from the pin to the lens is greater than the diftance of the lens from the bottom of the eye. And entering into a calculation in this way, it is eafy to prove that pictures are fometimes formed, the diameter of which does not exceed the 20,000 part of an inch; and probably that picture influences feveral nerves, becaufe we can judge of its parts, that one part is more round than another. Thus, perhaps, in the retina, the nerves are not the 50,000 or 100,000 part of an inch in their diameter, and it is impoffible to perceive their cavities, or the fluid they convey; fo are to judge from probibility, or by reafon, upon it, by comparing the brain with other parts, or attending to the phœnomena of the nerves.

DCXXIX.

The brain refembles fome of our glandular organs in its appearance; we may compare it with kidney. There is a vafcular and cortical fub-

ftance within that in the brain, what is called
medullary fubftance, and the fame name has been
applied to the tubular uriniferous part of the
kidney; and perhaps the nerves may be compared
to the tubuli uriniferi, or at leaft there is a diftant
refemblance between thefe organs and all the
other organs that have the appearance of blood
diftributed upon them, and that fend out hollow
tubes or ducts.

DCXXX.

Preffure upon the brain, though not fo made as
to deftroy its fubftance, has been found to bring
on convulfions of the mufcles. That, however, is
merely a probable argument, that fomething is
fqueezed out; but it may be occafioned many
ways, as from irritation to a certain degree. But
we know that moderate preffure upon a nerve
ftops its influence, as when we fit upon the edge
of a feat the whole leg fleeps; and, when we re-
move the preffure, we feel a fomewhat get into
the member, not without pain; we are almoft
afraid to rife off the feat, as if fomething had
been accumulated, and immediately defcended
into the nerve with more than common violence.
Or if a nerve is laid bare, running to a mufcle,
then the nerve cut acrofs, the mufcle becomes un-
active, but may be roufed into action by punc-
turing it; but there is another way, by moderate
preffure upon the nerve. If we prefs it in the

moſt gentle manner, without ſtretching it, we are
ſenſible of a motion following, as if we had de-
termined ſomewhat from the nerve down into
the muſcle. So that the moſt probable opinion
is, that the nerves convey a fluid. Still, how-
ever, we are very far from being certain of this,
becauſe every circumſtance may admit of ſome
other explanation, and is only mentioned as more
probable than any other opinion yet formed.

DCXXXI.

How far we are to add to this, that whilſt the
nerves convey within them a fluid, they are like-
wiſe charged with ſome other without them, or
in their coats.

DCXXXII.

With theſe obſervations we are led to examine
their more particular offices. They ſerve, as has
been ſaid, in general, for ſenſe and for motion.

DCXXXIII.

That the two firſt offices are moſt juſtly aſſigned
to them, is beyond all reaſonable doubt; for, the
moſt ſimple arguments prove it. When a nerve
is cut, the animal ſuffers no injury, no pain, from
irritating the member beyond the inciſion. In
like manner the member loſes the living principle
of the animal, it loſes all further power over the
member, the animal has it not in its power to
perform any motion with the muſcles of the part,
ſuppoſe the circulation to continue much as before.

DCXXXIV.

But now let us confider thefe two offices of fenfe and motion more particularly. Phyfiologifts, in general, ufe an improper term. Speaking of nerves, they call them the only fenfible parts, that the nerves only poffefs fenfe. But meaning to define with precifion, it may be faid only, that the nerves are fo difpofed in the body of an animal, as to give to it the fenfe of injury done to the body. We are not to imagine that we feel pain, but the nerve only gives the idea, or renders the mind of the animal, feated near its origin, fenfible of the injury.

DCXXXV.

It is material to attend to this, becaufe we perceive that, from want of attention, fome appearances furprife us, which admit of a ready explanation. If a perfon has had the leg amputated, and you irritate the end of the ftump, the end of the fciatic nerve, he feels pain, but not in the thigh or ftump, but the toes, in that part in which the nerve naturally terminates. And in doing this, he follows not merely a habit, but that fuch feelings are inherent in our very natuie ; and if the fame experiment were performed in the fœtus, it would be attended with the fame effect. So phyfiologifts have ufed a term of fenforium commune, fome part about the origin of the nerves, in which feelings are exercifed.

DCXXXVI.

One great difficulty is to be able to acquire an idea of the manner in which the nervous energy can produce its effects, which leads next to enter upon the nature of this energy, and particularly whether we are to imagine that it is derived in the manner of a secretion from the veſſels of the brain or cerebellum, or that it is of a very different nature, fimilar to the electrical fluid, or to the fluid named ether, or that it is fome fluid very different from this, the properties of which we are perfectly unacquainted with?

DCXXXVII.

Of late years, many ingenious phyſiologiſts, from not being able to conceive the manner in which a fecreted, call it a watery fluid, fhould perform fenfe and motion, have adopted the idea of an æthereal matter, or electrical fluid, acting along our nerves. If our nerves of fenfe and motion operate by means of an electrical fluid, or an ætherial, what is the ufe of the brain and cerebellum? If we admit the other idea of fecretion, the ufe is obvious. Are we to compare the brain to an electrical globe exciting this fluid? It is furely by a grofs comparifon. How next does the matter pafs along the nerves? How is it prevented from communicating its influence from one thread to another? Why does it not efcape from the nerves, as the electrical fluid paſſes

through the body? So far as they are loaded with a watery fluid, we do not find that they are more capable of conducting fuch a matter, than any other portion of the body equally wet. If the brain fome how or other excites this fluid by the blood moving through it, the more a perfon exercifes himfelf, the lefs he fhould be fatigued, more of this energy being excited and collected. Or how does a flight preffure upon a nerve ftop the energy? The preffure is made with any kind of fubftance as with a nerve taken from another animal, and tied round fo as not to injure its texture, and the energy totally ceafes. On cutting it through altogether, and replacing the nerves, bring the parts in contact, all influence ceafes: or feparating a member, and allowing time for the efcaping of fuch a fluid, we ftill find the energy remains. Inftead, therefore, of folving the old difficulties, we feem to be adding to them; and though it is difficult to conceive how any watery or fecreted fluid performs the office of nerves, yet it is as well to be conceived when we fubftitute fome other very penetrating and elaftic fluid. Do we conceive better of the action of the mufcles from a deluge of electrical fluid rufhing in upon it, or fome other fecreted matter? Or do not we fee that changes equally wonderful are produced by fecreted fluids: the body is formed, the generation of animals depends upon it, we underftand

not how, but we cannot deny the fact; fo, upon the whole, all we can fay is this, that it is the moft probable opinion, though far from being a probability next to certainty, that there is a fluid in the nerves; far lefs can we form the moft diftant idea of the nature of that fluid, or of the manner in which the mind of animals operates upon it. Nor is it reafonable to expect that the nature of it fhould ever be underftood; if it ferves to connect the material and immaterial parts together, as we are ignorant of the nature of mind, we fhall be for ever ignorant of that chain by which mind and body are laid together. Having knowledge, fo far as experiments will allow, of the nature of the nervous energy; for it is as much a point of found philofophy to know where to ftop, as to know when to proceed.

DCXXXVIII.

With thefe remarks on their offices, we next trace the nerves from their beginning to their termination, obferving the ufe of every part. In doing this, their coverings firft claim our attention. The dura mater defends the brain, and where the nerves are fent off gives a covering to them, is produced without the head with them, or fomewhat of the fame general nature with the dura mater accompanies them in their progrefs, and this is evidently for their defence. That the dura mater in the arm ferves the fame

office to the nerve as to the brain within the head. We need no other proof of this, than the compairing the firſt pair with the ſceond. The olfactory entering through holes into the noſe, needs no ſheath; but the ſecond pair paſſing to the bottom of the eye, and expoſed to the action of the muſcles of. that organ, needs the ſheath. So, with regard to the ſeventh pair conſiſting of two branches, the portio mollis within the os petroſum wants the ſheath, while the other portion without receives the dura mater. Or, tracing a nerve to its termination, as the optic nerve into the retina, the dura mater is again laid aſide: ſo we are never to connect the office of the nerve with that of this coat.

DCXXXIX.

Next, we meet with a coat of more conſequence, the pia mater, which covers the whole ſurface of the brain, entering into all its convolutions, and from the membrane there are branches plunging into the cortical ſubſtance, and that is connected to the medullary; ſo that we have no inſtance of a cortical matter that does not produce medullary; or we find no medullary ſubſtance that cannot be traced back to cortical. So we conceive that the pia mater is a membrane of the utmoſt conſequence to the brain, though no author has applied what he obſerves with regard to the brain, to the nerves in their progreſs.

Now it would appear that the pia mater, in the whole extent of the nervous fyftem, furnifhes to the nerves in their progrefs, what it does to the brain at their origin. For, firft, we obferve in the fpinal marrow a cortical fubftance, a cineritious matter. Now, furely, the fpinal marrow very much refembles any of its branches, dividing farther, fo we may look upon it as the principal nerve of the body; that, whilft the chief part is the production of the brain and cerebellum, an addition is made to the nervous energy or matter. And we have reafon to believe that the cafe is the fame with every other nerve; that as the furface of the fpinal marrow over the medullary part is cortical, fo that every nerve is cortical. Compare the whitenefs of the medullary fubftance with the threads of the nerves after they have left the brain, they are of a brown afhy colour, the threads lofe their whitenefs, and appear to do fo after we have feparated as much as can be done of the pia mater from them. The want of brain, alfo, in many animals, is natural; and in the human body, where the brain has been wanting, the fame kind of coats of the nerves have been found, and not very much fmaller than if the brain had exifted. Hence we would infer that [] at power we afcribe to the brain, may be in fupplied by the nerves, we feel only by a what about the origin of the nerves, but a

nervous energy roufed in the nerve can actuate a
mufcle.   Or let us attend to the effect which
ftopping the circulation in the veffels that accom-
pany the nerves has.   According to the common
idea of the nerves being derived from the brain,
the ftopping the circulation fhould by no means
·· have the great effect of preventing the nerve from
communicating its influence backwards to the reft
of the fyftem. If the femoral artery is tied, though
we apply opium to the inferior extremity, fo as to
bring on the want of motion, it is not communi-
cated through the nerve unlefs the circulation is
free along with it: fo we fhall be tempted to
imagine that the ufe of the pia mater is much
more extenfive than is fuppofed, and that this
vafcular coat ferves more important purpofes than
the merely conveying nourifhment to their coats.

DCXL.

Hence the difeafes of the nerves may depend
more upon topical caufes, and be more remedied
by medicines confined to the part than we are
generally taught to believe. In moft affections of
the nerves, the difeafe can be traced to the head,
but we may fuppofe confiderable difeafes to take
place from the want of a due circulation along
the nerves in their courfe or progrefs.   On going
deeper, we find the medullary part of the brain
every where intimately connected with the cor-
tical.   We find, again, that the nerves coming

from the medullary part, are evidently the conti-
nuation of its fibres; and we can trace the threads
of a nerve a certain way into the medullary fub-
ftance of the brain. But we are by no means to
conceive that the brain ferves only to form nerves
for fenfe and motion ; there are other latent and
important functions performed, we would be in-
clined to think fo from obferving the various di-
rections of the threads in the medullary fubftance,
from the much greater bulk of the brain than of
all the nerves. We find many bundles of medul-
lary fibres directed to oppofite fides of the brain,
and not to the beginning of the nerves. On
comparing different animals together, we find
upon the whole that the brain and the degree of
fagacity, vary in fome kind of regular proportion.
In man we find by much the largeft brain pro-
portioned to the fize of the body. In the quad-
ruped, the brain is larger than in the bird. In the
bird it is larger than in the fifhes.

DCXLI.

Wherefore functions of which we can give no
explanation, are better exercifed by a certain mo-
dification of the brain, or the powers of the mind,
by a certain modification of it, feem to be ex-
panded. We cannot help drawing a conclufion
of this fort from merely confidering the more
obvious circumftances.

DCXLII.

In tracing the nerves from their origin to their termination, we are next led to obferve the effects of connections among them, whether within or without the head.

DCXLIII.

There appears no room for imagining that the office of the brain and cerebellum are effentially different; that the one ferves for the animal, the other for the vital functions. For we find that the 1ſt, 2d, and 3d pairs are derived from the brain, fo the 4th and 5th from the cerebellum; but that the others are derived from the medullary fubftance of both intimately united. Next, let us confine our view to the origin of a fingle nerve: in a few places we can perceive that the nerves are united to both fides of the brain. This is more particularly remarked of the optic nerves; but in man, as well as in other animals, we can trace them to both fides; but, if we are to judge from the difpofition of moſt of the others, we would fuppofe that they take their rife from one fide only; yet plain obfervation feems to prove, that almoſt all our ſerves have a double origin. For if the right fide of the brain be injured, from Hippocrates down to the prefent time, it has been obferved that both fides of the body are affected, and it is difficult to determine which fide fuffers the moſt. On taking this in a general way, we

find the origin of our nerves to be more extenfive than at firft fight we are apt to fufpect.

DCXLIV.

Now, purfuing them from the head and fpine, in many places they are connected; and, upon the whole, the connections are of three different kinds.

DCXLV.

To begin with the moft fimple. In the axillary plexus, or in the nerves that are to fupply the inferior extremities, there is a joining of two or more nerves into one bundle, the cord they compofe being equal in fize to thofe which enter into it. After they run fome way, they are again feparated, or we fee new cords formed.

DCXLVI.

Suppofe, next, that a couple of mufcles are to be fupplied with nerves, we find a divifion; and it is in this way that each mufcle receives branches from each of the nerves, or that the firft nerve fupplies the firft and likewife the fecond mufcle, and the fecond does the fame.

DCXLVII.

Another kind of connection appears, for example, in the face. We fee nerves coming out of holes at a great diftance from each other; and, after fpreading into threads, thefe are connected together in a way reprefenting the anaftomofes of the blood veffels. Opening the fheath, the fame

things feem to happen as in the former anaftomofis, at leaft, fo far as we can judge of minute nerves, there is a croffing of threads, and no interruption of the threads at their union. The intention of this is, that if by any accident a nerve in its pro- grefs happens to be cut or compreffed, all the mufcles in which that nerve terminates may ftill preferve fome fhare of their power.

DCXLVIII.

But a third kind of connection is by means of ganglia. We find a number of nerves, as thefe between the vertebræ, running together, and where they meet, a great increafe of bulk, or a knot, is produced; and from the oppofite fides of that we find diftinct threads again fent off, in fome inftances nearly of the fame fize; but in others larger than the threads which enter, and more numerous in their appearance; and tracing the threads through them, they change their colour and appearance in every refpect. The ganglia are redder than the nerves, refembling the colour of a lymphatic gland; and it is as difficult to fhow threads running pa- rallel to each other through a ganglion, as to fhew threads in a conglobate gland, the fubftance ap- pears compact: fo we are much at a lofs to determine the nature and the ufe of ganglia. The threads, indeed, of the feveral nerves are here more intimately intermixed than in the former connections, and there may be other latent pur-

poſes which they ſerve, ſuch as have neither been proved or conjectured. Some authors conſider the ganglia as muſcular organs ſerving to puſh on the nervous fluid, whilſt others conſider them as forming an additional nervous influence. Others again ſuppoſe that a more intimate communication is made here, that the fluid is poured out into certain receptacles, and again conveyed to all the branches; and, of late years, it has been aſſerted that the ganglia are interpoſed to intercept the power of our will, and therefore to render certain motions of the body involuntary, ſuch as that of the heart, becauſe it is evidently unſafe to truſt the management of the heart to our diſcretion. But, though this opinion is ſupported with ingenuity, yet many reaſons enforce its rejection. Indeed, the diſtinction made of our actions into voluntary and involuntary, is by no means proper. The action of the muſcles is involuntary; we direct our arm to a certain object, but we have not the direction of our muſcles employed for that purpoſe. Next, the ganglia are not confined to muſcular organs; we have ſeen them in many of the glands, and in many of the muſcles, which are clearly voluntary, and every one of the muſcles of the extremities and trunk of the body is ſupplied with nerves that paſs through ganglia. Beſides, all the ſpinal nerves, before they come to the axillary plexus, paſs through ganglia.

DCXLIX.

But this leads on to a more general point, to
determine the cause of sympathy among our several
nerves; and the reason and manner in which the
variety of muscular motions is performed, whether
this depends merely on mechanism, or is directed
by a wise agent.　In considering sympathy in the
literal sense, we find that an injury is transferred
from one part of the nervous system to another,
or to the whole system.　We perceive that if any
organ of the body is violently irritated and in-
flamed, the irritation spreads more readily to the
neighbouring than to the distant organs, owing to
the connection which the hydraulic system has
with the nervous, the one acting and reacting
upon the other.　But we must likewise admit that
if a branch of a nerve be violently irritated, the
irritation or inflammation will more readily dif-
order others confined in the same sheath than the
distant nerves of the body; and sometimes we
meet with plain examples of that kind, though
not very frequently.　Thus, if a tooth be carious,
the irritation extends along the several nerves
inclosed in the same sheath with that; and we
find if the irritation is in the incifores of the
right side, that that side will more readily suffer
pain and inflammation than the opposite side.　Nay,
it is evident that there is some latent mechanical
connection of the nerves of one side of the body

with each other, producing remarkable effects. We fee frequent examples of hemiphlegia, where one fide of the body is affected with palfy, while in the other the mufcular power is preferved, which muft be owing to fome immediate connection the nerves on one fide have about their origin, or in their progrefs.

DCL.

We obferve, alfo, a general connection of all parts of the nervous fyftem with each other. Thus, if we touch the fciatic nerve with a drop of hartfhorn, burning the nerve will not kill the animal, but the flighteft application of this will. So, in the cafe of a bite of a rattle-fnake, from the connection of the nervous fyftem, all the parts fympathize.

DCLI.

But does it follow that the variety of regular motions of our blood depend upon mechanifm, whether from the connection of the nerves in their progrefs, or origin? Or, to explain the queftion, let us fuppofe an irritation applied to a particular organ. Suppofe that the nofe is irritated by any acrid matter, we fneeze in confequence of that. Now, how are we to account for this action, which is abundantly complex? Are we to fay, as generally has been done, that we can trace the connection from the nerves of the nofe, to thofe that regulate the motions of the

diaphragm and abdominal mufcles, and from that connection are to explain the action following the irritation. Thus, the firft branch of the 5*th* pair fends the nafal twig to the nofe, the fecond branch of the fame nerve fupplies the beginning of the great fympathetic or intercoftal nerve, or, running down from the head, is connected to the feveral dorfal nerves, in its paffage along to the phrenic ones, which regulate the diaphragm, &c.

DCLII.

Many arguments occur againft fuch an explanation. We have a fenfe of injury before any action enfues; or, if we are to confider this opinion in a general way, we find many objections arife againft it.

DCLIII.

If a nerve, when irritated, immediately throws into action all others connected with it, when we irritate a nerve of the fore arm for inftance, laying the nerve bare that it may act more readily, it fhould draw the mufcles inwards; but we act with different mufcles pulling the arm away. Or, how comes it that the intermediate mufcles with which the nerve in queftion is perhaps more connected, are free from action? Why do not the feveral mufcles of the face and neck act as violently as thofe of the diaphragm and abdominal mufcles? Or, whence the regularity of their action? Or, why does not an irritation applied

to other nerves, as a wound of the neck, immediately produce fneezing, in like manner as the irritation of the nerve within the nofe? May not we trace the fympathy in the reverfe way? Why does not the farther end equally influence the beginning? Or tracing the intercoftal nerve through the body, the motions are varied according to the place. If the nofe is irritated, we fneeze; if the throat, we vomit; if the irritation is within the breaft, or if there is a want of that fomewhat neceffary to life, as in over-heated air, our breathing is affected; but where, with the air, an irritating fubftance is conveyed into the trachea, we cough; fo a fimilar irritation applied to the fame place, produces a different action. Thus, with regard to the irritation within the abdomen; if it is in the ftomach, we vomit; if in the guts, purging is excited; if the irritation is in the uterus, there is a certain effort; if it is in the rectum and vefica urinaria, there is an effort of a different nature; and furely this variety cannot proceed from mechanical principles.

DCLIV.

On the other hand, the fame regular motion follows, where we can trace no connection. Do not we act with the iris, though the irritation is applied to the 2*d* pair, at the bottom of the eye? Nay, the two fides fympathize; the two eyes move in an uniform manner, which is not

from any connection with the optic nerve. And we are all fenfible, that almoft every action or impreffion firft influences our mind, the *living principle* is roufed, and the action follows it; or the imagination, in time of fleep, performs fimilar operations where the ftimulus is abfent. Therefore it is evident, that we cannot afcribe thefe regular motions to mechanifm, and muft give fome different interpretation of the matter.

DCLV.

In order to do this, let us review the principal actions in a general way, and obferve the reafon of the effects. Let us begin with thofe where the irritation is at a diftance from the acting organ. If an animal hears a confufed found, he expands the ear, and directs it to the fonorous fubftance, and the motions of the deep parts muft follow thofe of the external; or we obferve the accuracy with which the eye adapts itfelf to light, or with which the two eyes meet to examine the fame object: or in fneezing, coughing, &c. we perceive the motion varied according to the kind of irritation and effect which the motion may have in removing it. If a quantity of blood rufhes into the lungs, no action is fo fit for allowing it to pafs as infpiration; or if we have too fmall a quantity of living principle from the air, or the air is too light, we infpire more frequently. If an irritating fubftance be confined within the trachea, we

cough, which is a very complex action, but the
moſt effectual for throwing out the offending
cauſe if the ſtomach is affected, and it is unſafe
that the irritating ſubſtance ſhould paſs down-
wards; it is thrown back by vomiting, and that
likewiſe is a very complex action, performed by
means of nerves derived from very different ſources;
or, if the acrid ſubſtance gets into the inteſtinal
canal, the increaſed action of that is excited.   If
the irritation is in the bottom of the canal, beſides
the increaſed action of the coats of the inteſtines,
we bring into play the preſſure of the diaphragm
and abdominal muſcles in a regular manner, preſſ-
ing ſteadily, and with conſiderable force.   The
ſame thing happens in delivery, and in aſſiſting
the bladder of urine to throw out its contents, and
to open its mouth.

DCLVI.

If the bladder is irritated, the motion produced
is a gradual contraction, different from the action
of the inteſtinal canal, which plays backwards and
forwards, puſhing the food down, bringing it back
again, and applying it to the ſecerning veſſels and
abſorbents. We have the power over that, though
the bladder is ſupplied with nerves through gan-
glia, we can ſtop the action of the bladder, or
increaſe it, at pleaſure.

DCLVII.

If we next apply a ſtimulus to the muſcles of

our extremities, other mufcles are thrown into
action, while the arm is held faft, and the injury
kept applied, the mufcle vibrates, as the only way
it can free itfelf; and this has led phyfiologifts to
talk of mufcles being difpofed to contraction and
relaxation. They are in no fhape difpofed to that
ftate; do not we fee the contrary in the bladder
of urine? They only perform that action which
is moft fit. We fee the heart fubjected to an
alternate contraction and relaxation, as that kind
of motion is moft fit, the heart throws itfelf into
its utmoft action in an inftant, becaufe an action
approaching to the vis percuffionis is neceffary
to drive the blood through the veffels; and the
fame contraction in the bladder would have been
hurtful, without any purpofe being ferved by
them: fo thefe actions are regulated by a wife
agent, and it only remains that we determine the
agent.

DCLVIII:

In that circumftance authors fail, and their
views are greatly limited. An attempt has been
made to perfuade us that our mind reafons upon
all thefe actions; and after holding confultation
with herfelf, determines the manner in which
they ought to be performed. Whilft others would
perfuade us that thefe actions are dependent upon
our mind; but from a neceffity, not from a choice,
the heart is ftimulated, and the mind forced to

interpofe; otherwife the heart would be burft,
therefore it obeys the ftimulus, and contracts.

DCLIX.

Now it is perfectly clear, that we cannot rea-
fon upon fuch actions, becaufe we want data.
We are ignorant of the facts upon which reafon-
ing could proceed. We are not born confcious
of our ftructure, and we cannot be faid to do any
thing from neceffity which is beyond our power.
Let us only take in a few actions, where the opera-
tion will be allowed to depend upon fome other
principle.   An infant, the moment it is born,
breathes as regularly and in as proper a manner as
an adult.   It fucks, and fwallows regularly what
it receives into its mouth, and all this upon the
firft trial, as well as upon the laft.   By what
power can that be done ?   Surely we would fay,
by inftinct ; and by this we underftand a power
that exifted before we exifted.   Can we fay that
our mind, that we ourfelves poffefs a voluntary
power over our mufcles, and yet are nowife
confcious of the number, or fituation of thefe.
If we were, anatomy would be a needlefs ftudy;
but we know nothing of our mufcles; all our
power is, that we wifh to move a member in a
certain manner, to lay hold of fomething, and we
are confcious of that action, and do it readily,
but we know nothing of the regulation of the
mufcles about it, it is done for us, fo all muf-

cular action is involuntary. Nay, shew any muscle in our body to the most able philosopher; desire him to act with it, he cannot do it, unless you tell him the motion; then he wishes to perform that motion, and the action of muscle follows the wish.

DCLX.

So the more we consider the actions of animals, we find the greater reason to conclude, That the *Author* of *Nature*, who made and created them, continues, with *His* unceasing influence, to operate upon them, not by particular, but general laws, in such a way as is most fit to maintain them.

DCLXI.

Anatomical Preparation of the Vascular System.

To exhibit a full view of the vascular system, a young emaciated subject, not exceeding the age of 14, is preferred, and is even preferable if anasarcous. To prepare for the injection, an incision is first to be made through the teguments the whole length of the sternum, equally dividing the bone longitudinally with a saw into two. Under the divided bone, a knife is to be introduced on each side, separating the mediastinum; then by bending back the sternum and cartilages, the thorax, is laid open. The next step is to make an incision into the pericardium and left ventricle of the heart, and through the latter a pipe is to be introduced into the aorta ascendens, and then secured by ligature on the vessel. The body is then to be immersed in hot water, as directed in other cases, and the injection conducted

alfo in the fame manner.   The injection being finished,
the body is to be laid with the face downwards in cold
water to cool the injection as foon as poffible, and keep
it equally diffused in the veffels, without feparation of
its colouring part.

The injection being thus finished, the diffection next
follows, which is conducted by firft opening the abdo-
men, continuing for this purpofe the incifion from the
thorax to the pubes, and then removing the thoracic
and abdominal vifcera.   The ftomach and inteftines are
next removed by cutting the mefentery clofe to the
latter, fo as to leave as much as poffible of the mefen-
teric arteries.   The liver is next diffected, leaving as
much as poffible the ramifications of the hepatic artery.
In the fame manner are the kidneys treated, or they
may be left to dry, and the fpleen is removed with the
ftomach.   All the veffels left fhould be freed as much
as poffible from extraneous fubftance, in order to render
them diftinct.   The bladder of urine may be inflated,
and preferved whole with the rectum, and its connecting
membrane fhould be removed from the pelvis, fo as to
bring the internal pudendal artery into view.   In dif-
fecting the abdominal vifcera, care fhould be taken of
the fpermatic arteries from their length and flendernefs.
The thoracic vifcera are eafily removed.   The heart,
lungs, and æfophagus, are to be entirely removed, and
the thoracic veffels rendered by farther diffection as con-
fpicuous as poffible.

The divided fternum, in order to fhow the internal
mammary arteries arifing from the fubclavians, fhould
be bent back, and to effect this, the cartilages of the
ribs fhould be partly cut on the infide.

The fubclavians, carotids, &c. fhould be made confpicuous, and their ramifications traced over the head with much time and patience, and no more of the fkin fhould be raifed from any part at a time than is neceffary to carry on the differion, to prevent expofure of the fubject to the air and its drying; and in ufing the knife here, the edge fhould be kept to its inner furface.

In tracing the blood veffels, it fhould proceed from the large veffels to their ramifications, and the diffecting fciffars and forceps are the inftruments ufed after the raifing the fkin. The natural fhape of the cheeks and lips are to be preferved by filling the mouth with tow or wool. Then the extremities may be diffected. Firft, in the arm, after raifing the fkin, trace the veffels from the axilla to the ends of the finger; and in the lower extremities from the groin to the toe. Separate, alfo, and raife the mufcles cautioufly from each other, removing the fat and cellular membrane every where, without removing their attachments, except where the courfe of the veffels cannot otherwife be fhewn, as on the fide of the neck, and at the tranfverfe proceffes of the vertebræ. The pectoral mufcles fhould alfo be raifed; the glutæi elevated, or partly removed; and the mufcles of the dorfal and lumbar vertebræ on each fide fhould be taken away, in order to facilitate the drying of the fubject. The brain fhould alfo be removed through an opening in the cranium, as formerly defcribed.

The diffection being then finifhed, the body is to be fufpended in a cool free air by a cord from a hole in the fummit of the cranium. The mufcles are then to

be feparated by the intervention of wool from each other. The thorax and abdomen are to be divided in the fame manner; and in doing this, regard is ftill to be had to preferve their fituation, and to prevent the appearance of diftortion. The mefenteric, and other veffels, are to be placed in proper pofitions. The fame attention is to be paid to the fituation of the legs and arms, with the fame view of fhewing the veffels, 'T' one hand may be elevated over the head, the palm inclining forwards; the other may hang down perpendicular, with the palm forwards. The inferior extremities are bent in their natural pofition. Much attention is neceffary to preferve thefe pofitions during the dr procefs, and to avoid the putrefaction of any which, if appearing, fhould be wafhed off w   p lees, and à painter's brufh. The preparat   -'), fhould be immediately varnifhed.

Anatomical Preparation of the Nervous Syftem.

For this purpofe a fmall fubject is preferred. The diffection is begun by an incifion through the fkin from the lower part of the fore head, over the head to the occiput; and turning down the fcalp on each fide with the view of removing a circular piece of the cranium with a faw. The brain is then to be taken away, cutting the nerves in removing it clofe to the organ, and gradually proceeding from the 1ft to the 10th pair.

The olfactory, or 1ft pair, being too tender for diffection, the optic are to be fhewn by making a fection to remove the upper part of the orbit. By this fhould be fhewn the diftribution of the branches of the 3d, 4th, 5th, and 6th pairs, contained within the orbit. After

tracing the remaining branches of the 5*th* pair, they follow by the superior and inferior maxillary branches, dividing the lower jaw at its symphysis. The inferior maxillary branches are traced, one to the tongue, and another to the angle of the lower jaw.   The 8*th* pair is to be prosecuted with the intercostals from the base of the cranium into the thorax and abdomen, carefully diff ding all the branches.   The branches of the 9*th* 10*th* pairs are readily pursued to the different mus- which admit their ramifications.

In dissecting the spinal nerves, begin with the 1*st* I trace its several branches before proceeding to the .   d so in the cervical nerves, the branches which t.   he phrenic, should be pursued and traced to the diaphragm.   On completing the dissection, the subject is to be preserved in spirits.

PART III.

MORBID ANATOMY.

DCLXII.

OUR views have been now sufficiently directed to the state of the body in health. In this state it is seldom presented to the eye of the phyfician, and it is only under the influence of difeafe and derangement it becomes the object of his care. Morbid Anatomy, therefore, or the changes induced on the human fyftem by difeafe, claim our principal attention, and the former part we have hitherto confidered, is only ufeful in fo far as explaining the latter.

DCLXIII.

In explaining this divifion, it is proper to alter the arrangement formerly obferved; and inftead of commencing our inveftigation with the bafis of the body, we confider the parts in their order, as more or lefs effential to the continuance of life. On this plan we are naturally led to begin with the heart and its appendages.

DCLXIV.
Morbid Change of the Pericardium.

The pericardium, or covering of this organ, we find subject to various changes.

DCLXV.
Inflammation.

It is, firft, liable to inflammation, though not fo common, and when occurring, chiefly difplaying itfelf in the adult ftate. By this attack it is thickened, becomes pulpy and more vafcular, and upon its infide there is formed a layer of yellowifh pulpy matter, eafily feparated. The extent of this layer varies, as alfo its degree of thicknefs. From the pericardium fmall veffels fhoot into it, flightly reddening it, and frequently colouring it with fmall fpots of florid blood. Projections are alfo thrown out from it at times, forming an appearance refembling lace-work. The whole of this matter much refembles coagulable lymph. With this ftate of the membrane there is accumulated in its cavity a brownifh or yellowifh fluid. It varies in quantity from a few ounces to more than a pint. It is mixed with loofe pulpy matter, and fometimes alfo with puf. This fluid refembles the ferum. The inflammation of the pericardium is generally communicated more or lefs to the heart.

DCLXVI.

From the layer of coagulable lymph infpiffating, a new vafcular congeries is produced; and by this

congeries a quantity of ferum is poured out, and afterwards taken up by the abforbents of the fame part as the difeafe recedes. Pus alfo is difcharged from the arteries of this part, as there is no other fource from which it can be readily produced.

<div align="center">Symptoms.</div>

The fymptoms of pericardial inflammation admit no diftinction from thofe of the heart; and that organ always participates in the fame ftate when the inflammation is violent. The moft ufual mark of it is general fever, or increafed action, accompanied with pain of the heart, which is generally attended with palpitation, irregular pulfe, cough, dyfpnæa, and fometimes fyncope.

<div align="center">DCLXVII.</div>

<div align="center">'dhefion.</div>

This membrane is alfo fubject to adhefion to the heart. Its extent varies from a few points to the whole furface, and the adhefion is formed either by a thin membrane, fuch as the cellular elfewhere, or a folid matter like coagulable lymph; and both are very vafcular. Thefe adhefions are always the effect of a previous inflammation; and the period of its occurrence may be judged of by the degree of adhefion, being loofe in cafes of old date, and firmer in the more recent.

<div align="center">Symptoms.</div>

The fymptoms of this ftate are not always

clear, except where the adhefions are clofe and extenfive. They are then marked by oppreffion and pain in the fituation of the heart, an irregular, and at times intermittent pulfe, dyfpnæa, and dry cough.

DCLXVIII.
Dropfy.

This affection is frequent in advanced life, though it may occur at every age. It is found by itfelf, but at other times accompanied with dropfy of the other cavities. Its quantity varies from two ounces to more than a pint; and whatever is the extent, no tenfenefs of the pericardium is difplayed, which, perhaps, enlarges with the accumulation. The colour of the fluid is moft frequently yellowifh, and refembles in its properties the ferum.

Symptoms.

Water in the pericardium much refembles the fymptoms of hydro-thorax; but the feeling of oppreffion here is more ftrictly confined to the fituation of the heart, which is alfo more difturbed in its functions; and this oppreffion will be alfo moft felt when laid in the horizontal pofture, though the two difeafes are, for the moft part, conjoined.

DCLXIX.
Drynefs.

This membrane has been found occafionally like a dried ox's bladder, from a want of the fecretion of its natural moifture; but it is a rare occurrence.

Symptoms.

The peculiar symptoms that mark this state are perfectly unknown.

DCLXX.

Tumours.

Small tumours have been seen growing within the cavity of this membrane. From their containing a white soft matter, with a curdled or cheefy appearance, they have been referred to a scrofulous origin.

Symptoms.

Where this appearance occurs, it is generally combined with a difeafed state of the lungs; and when the tumours are so large as to disturb the functions of the heart, this difeafe will then be distinguished by similar symptoms as when its disturbance arises from other causes.

DCLXXI.

Hardness and Offification.

The converfion of this membrane into cartilage is only very partial; and, in a similar manner, it is occasionally changed in certain points into bone, and the latter is more frequent and extensive in its progress than the former. This state has been marked by no peculiar symptoms.

DCLXXII.

Defect.

From a defect in the original formation, a want of this membrane has been met with; and,

in that cafe, the heart and its veſſels are feen at once completely on opening the thorax. A clofe. and uniform adhefion may be miftaken for it, but here the heart and its veſſels do not come fo readily into view, and an adhefion prevails at the fame time to the tendinous part of the diaphragm ; while, in the former cafe, the heart lies bare in the cavity of the cheſt.

DCLXXIII.
Symptoms.

This ſtate is attended with no peculiar fymptoms.

DCLXXIV.
Morbid Changes of the Heart.

The morbid affections of the heart may be divided into two kinds, thofe arifing from malconformation or difeafe; and wherever this organ is affected, confequences follow greater than we can explain from mechanifm. The patient has anxiety and oppreſſion beyond defcription ; a quick pulfe, the confequence of irritation, but it is irregular and intermitting in various degrees; and we are to conceive thofe changes depend upon the fenſibility of the organ, and the fympathy which the body has in general with it, and particularly the nervous fyſtem is confiderably irritated.

DCLXXV.
Affeſtions of Malconformation.

The difeafes of malconformation are various, according to the particular part where the fault lies. The moſt frequent affection of this kind depends on a fault of the pulmonic artery; and this again prevents the clofing of the foramen ovale. The blood, therefore, does not paſs, or but imperfectly, into the lungs; it is merely ſent from the one ventricle to the other through the foramen ovale; and in this ſtate, without oxidation, it is tranfmitted into the aorta. If the blood paſſes in part into the lungs, life continues fome time; but if not, the child generally expires a few hours after birth in convulfive ſtruggles.

DCLXXVI.

The next affection of this kind is the commencement of the aorta over the partition of both ventricles, without its being particular to either, by which an opening or a free paſſage takes place to both ſides of the heart. This conformation is alfo joined with a narrow or contracted ſtate of the pulmonic artery. Thus the quantity of blood oxidated is merely what paſſes through this contracted veſſel; and when returned to the heart and mixed with the maſs, it is barely fufficient for prolonging a miferable exiſtence.

  this circulation large coagula of black blood m. The fize of the organ becomes confiderably

enlarged, while the ftructure of the lungs decays
and fhrinks.

DCLXXVII.

A third affection of this clafs, is an additional
cavity to the heart or middle ventricle, in which
the pulmonic artery and aorta both begin; fo that
the right ventricle fends out no pulmonary artery,
and the left ventricle no aorta. By this means,
as all the blood is poured into this middle ven-
tricle, only one half goes to the lungs, and the
oxidation is therefore incomplete to that extent.

DCLXXVIII.

The fymptoms of thefe various fpecies of mal-
conformation are marked by difficult refpiration,
blacknefs of face, which foon extends over the
reft of the body; convulfions repeated at intervals,
and general palpitation and throbbing of the heart,
fo as to be externally apparent to the eye. When
fome oxidation takes place, and life is protracted,
the marks of imperfect oxidation are confpicuous
by the dead or livid unhealthful colour, by the
langour and want of motion, by the coldnefs and
deficiency of vital heat, which nothing can re-
move; by occafional fits, by oppreffion and anxiety
at the heart, by diftreffed refpiration on the
flighteft hurry or action, and by the breathing
being eafieft in the fit, and the child acquiring re-
lief by it.

DCLXXIX.

When the malconformation is in a lefs degree, the marks of this ftate often do not appear till fome time after weaning, and when more oxygen than what the lungs can draw in is required for the wants of the fyftem. There is always, along with thofe fymptoms, marks of imperfect nourifhment.

DCLXXX.

DISEASES OF THE HEART.

Inflammation.

Inflammation of the heart is rare, except when connected with that of the pericardium, and then the affection of the latter paffes fome way into its fubftance, which, in that part, becomes more vafcular, and fhews fome marks of bloody extravafation. Inflammation, however, of the heart itfelf may occur; but it is hardly to be fuppofed, as has been alleged, that this organ can pafs into abcefs or ulceration, as death muft take place long before

Symptoms.

Inflammation of the heart is marked by the fame train of feelings that diftinguifh that of the pericardium. Syncope, however, will be more frequent here than in the former.

DCLXXXI.

Spot.

The furface of the heart often exhibits a white opake fpot at one part, of various fize, from a fix-

pence to three times the extent. Its moſt frequent
ſituation is the ſurface of the right vetricle, though
occaſionally elſewhere.   It ſeems an adventitious
layer from the pericardium.

Symptoms.

It is of little conſequence, and is therefore not
marked by any peculiar ſymptoms.

DCLXXXII.

Polypus.

The next affection, the diſorder termed a po-
lypus, though it is not ſo frequent as many ſeem
to conceive, is yet not to be altogether denied,
for the blood does coagulate after death without
the acceſs of the air; ſo, if a perſon from terror,
&c. has fallen into a faint, and continues for
ſome time in it, we may conceive a coagulation
to have taken place, conſiſting of coagulable lymph
filling up ſome of the cavities, and extending to
the large veſſels, which is perhaps not to be re-
moved, by the ſucceeding action of the heart;
and where after diſſection nothing is found but a
very firm coagulum within the heart, this could
not have happened *in articulo mortis*, and we may
conceive that it happens here as in the caſe of
aneuriſm.

Symptoms.

We judge of this by the cauſe, and by finding
that the perſon in certain poſtures is more uneaſy
than in others, for the polypus may be ſituated ſo

as to cover the mouth of the ventricle, and may
be removed by posture.

DCLXXXIII.

Enlargement.

The enlargement of the heart, for the most
part, depends upon the offification of the valves,
particularly thofe of the aorta.   This part is more
fubject to preffure, and therefore to this accident;
for the blood is thrown through a narrow paffage
with violence, and the artery re-acting, the valves
are fhut; fo they are fubject to preffure both from
the heart and arteries, and in moft people put to
hard labour, we find an offification about the
mouth of the aorta, and this difeafe in the human
body is much more frequent than is commonly
imagined.   Its termination is fudden, for fuch
perfons die fuddenly.

Symptoms.

The manner of diftinguifhing the difeafe is this:
The patient feels anxiety, oppreffion, the pulfe is
irregular, generally intermittent, and for the moft
part weak.   He complains much of heat about
the breaft, and perhaps this may be fome times
real, but often it is a mere deception; and the
motion of the heart and of the lungs do not go
on in the ufual manner.   Sometimes he complains
of heat in the reft of the body; but generally, to
a perfon feeling the limbs, there is an evident
fenfe of coldnefs, and often the patient complains

of coldnefs in the extremities. If he makes any attempt to walk up hill, he is quickly obliged to ftop, foon becomes extremely opprefſed, and feeling the pulfe, it is irregular at that time. But the diftinguifhing pathognomonick fign is, that the heart ftrikes the fide lower than the common place. It has been obfcrved that the point of the ventricle ftrikes the thorax as low as the 9th rib; and if, upon laying the patient on the left fide, we find the ftroke under the 7th rib, we may be certain that there is a confiderable dilatation. This depends upon the conftriction of the orifice, and we may in fome meafure form an opinion of the degree of that. Some patients live much longer under the complaint than others, and in a manner we cannot account for. Upon applying the hand to the fide, we feel a great many more ftrokes given to it than we find given to the finger applied to the pulfe. Upon making the experiment, 120, or 130, may be reckoned, when it is impoffible to reckon above 86, or 90 ftrokes of the pulfe, many of the ftrokes being fo weak that they were foon loft.

DCLXXXIV.

Offification of the Semilunar Valves.

The moft common offification about the heart is that of the femilunar valves, depending on the depofition of a bony or earthy matter from the fmall nourifhing arteries. But without offifica-

tion, they are alfo found confiderably thickened, and white and opake in colour, and the neighbouring arteries partake likewife in a certain degree in the fame ftate. This thickening is fometimes attended with a rupture, though it is a rare occurrence.

DCLXXXV.

Offification of the Auricular and Ventricular Valves.

These valves are liable to affume the fame morbid ftate as the former; but by no means fo frequently as the former, from their belonging more to parts of a venous nature. As well as fuffering offification, they are alfo fubject to a thickening and opacity, and which is extended to the chordæ tendineæ, and lining of the ventricle. Even inflammation of thofe parts occurs at times.

DCLXXXVI.

But an enlargement of the heart is apt to occur without any particular organic caufe. In this cafe the mufcular cavities are often not thick in proportion to the increafe of fize. The heart is generally found filled with blood, partly formed into a loofe concretion.

Symptoms.

The marks of this morbid ftate are frequent palpitations, fo ftrong as to be perceived by the eye without the clothes. In general, the pulfe is feeble and irregular. At times there prevails dyfpnæa, with a purpleifh hue of the cheeks and

lips, which varies in deepnefs according to the degree of dyfpnæa. Rheumatifm has been ftated as a caufe of this affection.

DCLXXXVII.
Aneurifm.

This organ has at times become aneurifmal, part of it dilating into a pouch filled with coagulated blood, and lined with a thick white opake membrane. This depends on a weakening of the mufculur fibres in the part which yields to the impulfe of the circulation. But the moft frequent feat of this difeafe is at the arch of the aorta, which becomes much enlarged, forming either a uniform tumor, or fmaller fwellings arife out of the large one. This tumor is filled more or lefs with coagulated blood, difpofed in concentric laminæ, and the coats of the artery preferve a proportional thicknefs to its enlargement, a new depofition gradually taking place by the action of their fmall veffels. The coats of the artery are accordingly here more divifible into layers, occafionally difplaying in them fpots of bony matter, often of a yellowifh colour. In the neighbourhood of the difeafe, the arterial coats differ in their thinnefs and thicknefs at different places, and always bear more or lefs marks of difeafe.

The difeafe fometimes terminates by a rupture and effufion into the pericardium at once, but more frequently it is flow in its progrefs, and the

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fwelling gradually increafing, it preffes at laft against the fternum and ribs, a portion of which becomes abforbed, and the tumor appears externally. In this manner it attains at laft the fize of a child's head at birth, and the fkin lofing entirely its vitality and cracking, part of the coagulated blood is forced out, and the patient is either inftantaneoufly cut off; or if it is flower, finks gradually under the difcharge.

The arch of the aorta, from its curvature, is more particularly the feat of aneurifm, as the blood preffes againft it with full impetus, and it occurs often in men, but rarely in women, whofe arterial fyftem feems lefs fubject to difeafe.

Symptoms.

In its early ftage, this affection is marked by a ftrong pulfation felt in the cheft, vifible to the eye on the thorax being expofed. The pulfe at the wrift is fometimes irregular, dyfpnæa on exercife always attends, and that in proportion to the progrefs of the difeafe. But the moft certain fymptom is the appearance of an external tumor, with ftrong pulfation.

DCLXXXVIII.

Rupture.

Rupture of the heart fometimes occurs, and chiefly to men in advanced life. The blood efcaping into the pericardium, death immediately enfues. It is the confequence of exertion at the

time, and fome part of the organ being thin. Without rupture blood has been accumulated in the pericardium to a confiderable quantity, and this muft have been fupplied either by the coronary or pericardial veffels.

Symptoms.

The fymptoms of blood effufed gradually into the pericardium are great faintnefs, dyfpnæa, confiderable anxiety and oppreffion, with dull pain, and weight behind the fternum. Thefe fymptoms are fucceeded by cold clammy fweats.

DCLXXXIX.
Hydatids, &c.

Hydatids have been found, though a rare occurence, adhering to the heart, and a part of the organ has been alfo converted into bone, and earthy depofitions form in its mufcular fibres, which are rare phenomena.

Symptoms.

In the firft cafe, the fymptoms will be the fame with thofe of water collected in the pericardium, with particular tendency to fainting.

In the latter cafe, palpitation of the heart and dyfpnæa have been the leading marks.

DCXC.
Difeafed Arteries.

After the heart, fome obfervations occur on the affections of the arteries, particularly aneurifm, as not being confined entirely to the arch of the

aorta.   From the ſtructure of the arteries, beſides
accidents ariſing from wounds, we may conceive
that they may be dilated or ruptured; or we con-
ceive a dilatation taking place in a certain degree,
and a rupture afterwards, ſome ſudden violence
producing a laceration of their coats. So aneuriſm
is divided into two kinds, where the whole, or
where only a few of the coats are ruptured or cut,
and this rupture may be occaſioned by an effort of
the artery: ſo, by blowing in air, the firſt coat
has been burſt, and the reſt yielding, a ſack was
formed, and it is ſeldom that all their coats are
found dilated; for it generally happens in one
part only, which comes to be ſo much diſeaſed,
that it is impoſſible to ſay what particular part is
affected; for as to the marks that have been pro-
poſed, that the branches of the arch of the aorta
will be found at a great diſtance, that would
have more readily happened if the other coats had
been corroded: ſo we may ſuppoſe all the coats
dilated, or we may ſuppoſe that all the coats ſhall
ſuddenly give way, that by a ſudden effort of the
ventricle the aorta may burſt, even though it is
not previouſly diſeaſed; or, after the dilatation is
advanced a certain way, the coats may be con-
ſumed by preſſing againſt ſome hard and reſiſting
ſubſtance, in conſequence of which a rupture will
readily take place.   Thus, in ſome caſes, the ſter-
num has been ſplit from the top, and has come

to be opened the whole way down, fo that the
aneurifmal fac has been fituated juft where the
arch of the aorta paffes over the left branch of the
trachea.

DCXCI.

The caufes of aneurifms are various, and a
number of circumftances may be fuppofed to
occur. Nay, we fhall find aneurifms where it is
impoffible to give any explanation of the caufe:
no caufe can be affigned for the various dilatations
which occur in different parts of the body. The
arteries are fubject to a certain rupture, and we
may fuppofe that we underftand how this may be
occafioned, by the violent action of the heart;
but how are we to explain a circumftance of the
heart itfelf, that it is found to give way even in
its thickeft places ?

DCXCII.

Of this we are apt to overlook the real caufe,
to conceive fomewhat impelling the blood with
force, fo as to occafion the rupture; and there-
fore that it is done from preffure.   Ruptures have
happened in that way.   Thus, the right auricle
is filled with blood, and if the patient makes
a violent effort in expiration, and bends the body;
perhaps, at the fame time, the expiratory organs
and other mufcles will prefs with fuch force upon
the auricle, that the parts of it may give way;
but, in other inftances, we muft fuppofe an exer-

tion of its own fibres to produce the laceration; for not merely the tendons of the mufcles may be lacerated by a fudden effort, but the mufcles themfelves. Thus, the calf of the leg is known to be lacerated from a perfon's making too great an exertion with the mufcle; and we mult account for the laceration of the heart in the fame manner. Nay, we cannot account for the dilatation of the heart in every part, from an affection in the beginning of the aorta. It is not the force of the blood running in from the veins that occafions the dilatation; the only caufe is the action of the heart itfelf, which, by endeavouring to make itfelf fmaller, is increafed. This may feem paradoxical; but the more it is confidered, it will appear more evident, for the heart makes a violent effort to throw out the blood, which is repeated in proportion to the refiftance that it meets with; and hence the quicknefs of the pulfe in feverifh diforders. By the effort, the fibres are diftracted; there is an endeavour of thefe to fhorten; but, when the effort ceafes, they in reality become longer than before. Thus the particles of the fibres are drawn afunder, and the void is gradually filled up, till the heart is by degrees dilated, and we find little lofs of fubftance, but the thicknefs feems to increafe in proportion to the dilatation.

DCXCIII.

There is fome danger of miftaking tumours
of the aorta for tumours of another kind, or of
miftaking thofe for tumours of the aorta; for
fometimes the artery does not enlarge equally,
but a part of the blood ftagnates out of the courfe
of the circulation, coagulates, and gives fuch a
degree of firmnefs, that we can eafily diftinguifh
the pulfation; and, on the other hand, fometimes
tumours of another nature, whether containing a
fluid, or compofed of folid matter, happen to
form near an artery, and have the ftroke of the
artery communicated to them.

DCXCIV.

Diseases of the Pleura.
Inflammation.

The invefting membrane of the thorax, or
pleura, is the frequent feat of inflammation, efpe-
cially on attaining the adult ftate, and it is more
fo than that of any membrane lining a cavity
which has no external opening. Hence, marks
of inflammation are confpicuous here on almoft
opening every fubject. It is marked by its thick-
ened pulpy ftate, its vafcular appearance, and its
furface covered by coagulable lymph of various
thicknefs, fometimes fmooth, fometimes reticulated
like lace-work, and attended with an effufion of
ferum into the thorax. This coagulable lymph is
the medium of adhefion, being formed between

the lungs and thorax; and it may be traced in its progrefs from the ftate of lymph till vafcular, and formed into cellular membrane. The inflammation of the pleura of the lungs is frequently extended to the organ.

Symptoms.

The fymptoms of pleurify are general fever, with acute pain in the lateral part of the cheft, increafed by infpiration, dyfpnæa, cough, and difficult recumbence on the affected fide.

DCXCV.

Adhefion.

One of the moft frequent morbid appearances on opening the thorax, is adhefion between the containing pleura and its layer on the lungs, without any exifting marks of inflammation. Being moftly partial, their moft common feat is the upper pofterior part of the cheft, though they at times extend over the whole cavity. The connection they form is of two kinds, either by a clofe adhefion of firm thick membrane, or of a loofe complex layer of cellular matter. Such adhefions muft always be the effect of previous inflammation.

Symptoms.

It is only when the adhefions are firm and fhort, fo as to confine the expanfion of the lungs, that this ftate is marked by external fymptoms. Thefe are difficult refpiration, cough, and an attending fever.

DCXCVI.

Empyema.

The accumulation of pus in the cavity of the cheft, forms empyema; and it arifes either from the veffels of the pleura under inflammation form-ing pus, or from an abcefs in the lungs burfting into the thoracic cavity. Pus may be formed in the pleura without ulceration, in confequence of the excretion of coagulable lymph on the furface; and it may either fill the whole cavity; or, in confequence of adhefions, be circumfcribed to a certain part.

Pus alfo from an abcefs in the lungs, is almoft always circumfcribed in its extent by the previous adhefions formed; though not in general can an external fullnefs be perceived on the fide where the accumulation is, and even a fenfible fwelling perceptible to the feel. Ulceration has, at times, likewife occurred in fome of the inter-coftal fpaces, and matter from it is feen difcharged outwardly.

Symptoms.

The fymptoms of empyema are previous in-flammation of the pleura or lungs, on the remif-fion of which rigors take place, with an abatement of pain. Cough, and dyfpnæa ftill continue, and an eafier recumbence is allowed on the difeafed fide. Sometimes external enlargement gives farther evidence of the morbid ftate

DCXCVII.

Hydro-thorax.

A watery fluid in one or both thoracic cavities conftitutes hydro-thorax. It is generally attended with the fame ftate of the other cavities, efpecially of the pericardium and lower extremities. The fluid contained here is of a brown or yellowifh colour, with an occafional reddifh tinge. In its general properties it refembles the ferum, varying occafionally both in its nature and extent, from fome ounces to an equal number of quarts. From the latter quantity, the accumulation appears externally on one fide by the apparent fullnefs. The effect of it is a greater or lefs compreffion of the lungs, fo that one fide of them is found at times larger than the clofed fift. Water alfo often accompanies adhefion, marking the prefence of former inflammation.

Symptoms.

The marks of hydro-thorax, in its advanced ftage, are pretty clear. Difficult breathing, and no reft, without elevation of the fuperior parts of the body, are leading ones. Suddenly interrupted fleep, with alarming dreams, retention of urine, and œdema of the extremities alfo attend. The pulfe commonly, though not always, is irregular. Sallownefs of colour, and a purple hue of the lips and cheeks, are confpicuous, as marking the compreffion of the organ, and imperfect oxidation of its circulation.

DCXCVIII.
Deficient Secretion.

The natural internal moifture on the furface of the pleura is fometimes found wanting, or in fuch quantity, that it appears almoft dry.

Symptoms.

This ftate is marked by no peculiar fymptoms.

DCXCIX.
Offification.

An occafional point, or thin plate of bone, more or lefs extenfive, is found in the pleura, from its veffels taking on the particular difpofition favourable to the formation of this matter. This appearance is common to all membranes, but more to the pleura than to any other; and unlefs forming fharp proceffes, or very extenfive, this change cannot be attended with much inconvenience.

Symptoms.

Where this affection is extenfive, the fymptom of difficult breathing will arife from want of full expanfion of the lungs, or free movement of the ribs.

DCC.
DISEASES OF THE LUNGS.
Inflammation.

Inflammation of the lungs and pleura are conjoined. By inflammation the fpongy ftructure of this organ is more reddened, partly of a florid,

and partly of a dark red hue. An extravafation of coagulable lymph, and occafionally of blood, takes place into the fubftance of the lungs. With this morbid change their fpecific gravity is increafed, they fink in water, and feel folid to the preffure of the finger, in proportion to the degree of inflammation. The pleura difplays alfo an increafed vafcular appearance, with a layer of coagulable lymph covering its furface. The inflammation of the lungs differs from their extravafation after death, by the want of increafed vafcularity, or marks of inflammation of the pleura, and by the colour of the lungs being of an uniform dark fhade, without any floridnefs.

Symptoms.

The fymptoms of inflamed lungs are much the fame with thofe of pleurify, only the pain is lefs acute, and the pulfe not fo hard. There is here difficult refpiration, accumulation in the veins of the neck, face fwelled, and a purpleifh hue of the lips and cheeks. On fuppuration taking place, rigors occur, with diminution of pain, and expectoration of pus.

DCCI.

Abfcefs.

Abfcefs is a common appearance in the lungs, confifting either of fmall cavities containing pus, or at other times of large ones, deftroying almoft their whole ftructure. Thefe cavities either communi-

cate alone with branches of the trachea, or opening into the thoracic cavity, pour out their contents so as to form empyema. Deep seated abscesses occasion the pleura to be little affected, but in the superficial ones it assumes inflammation.   The texture of the lungs is rendered more solid in the neighbourhood of abscesses, but in scrofulous cases this does not take place, as commonly appears in small abscesses.   In the vicinity of an abscess the pulmonary vessels are much contracted, and their extremities, before re-uniting, are almost entirely closed or filled with coagulated blood, as an effort of nature to prevent hemorrhage.

Symptoms.

The symptoms are here the same as described in the termination of the pulmonary inflammation.

DCCII.

Tubercles.

Tubercles are the most frequent morbid appearance in the lungs, and consist of round firm white bodies, interspersed through its substance. Their seat is the cellular substance that connects the air vessels.   Their size at first is not larger than a pin head accumulated in clusters, which pass into one larger one, and the smallest tubercle is not below the size of a garden pea, though admitting a great variety.   Their adhesion is close to the lungs, without any peculiar covering or increased vascularity.   When cut into, their struc-

ture difplays a white, fmooth, firm fubftance, con-
taining in a part of it a thick curdy pus; and in
its farther progrefs, by the increafe of fluid, a
white capfule comes only to be left, forming a
covering to this fluid.

The connection of feveral tubercles always tends
to the formation of pus. The appearance and
confiftence of the pus is regulated by its quantity,
being thick when fmall, but thin when in large
proportion. On diffection, feveral tubercles are
often found advanced to the ftate of fuppuration,
while the interftices of the pulmonary fubftance
near them difplays a hard firm texture, and an
obliteration of cells. Where fmall abfceffes occur,
the difeafe is evidently fcrofulous, and exhibits a
thick pus. The converfion of tubercles into ab-
fcefs forms phthifis pulmonalis, and tubercles are
formed in every period of life, though moft fre-
quently before the completion of growth. They
are alfo frequently produced in the advance of
life.

Different from tubercles, on diffection of the
lungs, part of their fubftance is found changed
into a foft whitifh matter, of a femifluid con-
fiftence, refembling an imperfect fuppuration; and,
while the tubercle is circumfcribed, this ftate is
more diffufed through the cellular fubftance.

Another variety of tubercle is alfo occafionally
confpicuous, confifting of a light brown, fmooth

fubftance on the furface of the lungs, equalling a
goofeberry in fize, without any capfule, or ap-
pearance of matter formed; and fometimes they
are even much fmaller, and extenfively difperfed.
The peculiar morbid procefs forming them is un-
certain.

Symptoms.

Incipient tubercles are marked by a flight cough,
occafional dyfpnæa, and a fomewhat quickened
pulfe, fymptoms frequently overlooked for a long
time. In the progrefs to fuppuration, there ap-
pears an expectoration of thick pus, occafionally
mixed with blood, gradually producing emacia-
tion, debility, and hectic fever, with its concomi-
tant fymptoms.

DCCIII.
Water.

From an accumulation of the aqueous moifture
naturally intended to facilitate the eafy motion of
one part of the lungs upon another, difeafe arifes,
forming what may be properly termed anafarca of
the lungs. In proportion to this accumulation of
water in the the cellular membrane, a compreffion
of the air cells will take place, and an imperfect
oxidation of the blood from the deficient quantity
of air will arife as a confequence.

Symptoms.

Where water exifts in this fituation, the ufual
fymptoms of dyfpnæa and cough will attend; but

the fame accumulation will alfo fhew itfelf in other parts of the body.

DCCIV.
AIR.
External Accumulation.

Rupture of the membrane of the lungs may take place occafionally, and the air may be effufed into the thorax, though this happens but feldom, becaufe the outer membrane is not put to the full ftretch when the lungs are diftended, and the containing parts give it a fupport. When it happens, the diaphragm is found convex, and, on opening the thorax, a great blaft of air will be found to iffue out. The lungs of that fide appear compreffed and fqueezed, at the top of the thorax, to no bigger a fize than that of one's fift, and they are almoft as hard as any other of the folid vifcera, without the probability of inflating them, by blowing in air from the trachea.

Symptoms.

The fymptoms here are, fharp pain of the fide fucceeding a violent fit of coughing, followed by difficulty of breathing and fwelling of the fide, often diffufed over the whole body, where the pleura is joined in the accident, and the rupture extends through it.

DCCV.
Internal Accumulation.

Diftenfion of the lungs with air is a common

appearance on opening the thorax, no collapfe of them taking place, and their furface being covered with numerous white veficles. In this cafe the branches of the trachea are alfo found gorged with mucus.

DCCVI.

Enlargement of the Air Cells.

An enlargement of the cells of the lungs is an occafional appearance, from the difficult egrefs of their contents, and the rupture, perhaps, of two or three into one larger cavity.

Symptoms.

The marks of enlarged air cells are long difficulty of breathing, but no farther difcrimination has been made from external fymptoms of this peculiar morbid ftate.

DCCVII.

Preternatural Formation of the Air Cells.

Such cells are feen at times attached to the edge of the lungs, without communication with the ftructure of the organ; and they are certainly a morbid growth, receiving their air from the veffels that ramify upon them.

Symptoms.

No peculiar fymptoms characterize this morbid appearance.

DCCVIII.

Hepatic Appearance of the Liver and Lungs.

The lungs are often feen converted into a folid

fubftance, of the fame general appearance and
folidity as the liver.   It is the effeft of fudden and
large extravafation of coagulable lymph into their
fubftance.   In confequence of this, from the de-
gree of compreffion, a total interruption of their
office muft enfue.

Symptoms.

This ftate is marked by violent inflammation,
and the fudden fatality of the attack.

DCCIX.
Earthy Concretions.

The appearance of earth in the lungs, though
rare, has at times been met with.   The maffes
formed by it are generally very fmall.   Part of
the lungs has even been converted into this fub-
ftance.

Symptoms.

Along with difficult refpiration and cough fome
of this earthy matter is brought up, which fhews
the peculiar morbid ftate.

DCCX.
Hydatids.

Hydatids of the lungs are an occafional morbid
appearance, fimilar to hydatids in other fituations.

Symptoms.

The attendants of this ftate are dyfpnæa, and
frequent cough.   Being forced up by violent
coughing, their appearance charaflerizes the dif-
eafe.

DCCXI.

Thyroid Gland.

Inflammation of the thyroid gland is a rare occurrence. It does, however, at times take place, and an increafed vafcularity of its fub-ftance, and extravafation of coagulable lymph both increafing its ufual fize and firmnefs, is a natural confequence of this affection.

Symptoms.

Inflammation here may be known by the increafe of fize, by a fenfe of pain in the part, felt more fevere on preffure or fwallowing, and it is chiefly diftinguifhed from other affections here by the rapidity of its progrefs.

DCCXII.

Bronchocele.

The moft frequent affection of this gland is its chronic fwelling, named bronchocele. It appears a hereditary diftemper, more common to women than men, and confined chiefly to certain countries or diftricts. This fwelling often enlarges to a prodigious fize, with an irregular growth, pro-jecting anteriorly upon the neck. This is parti-cularly remarkable in Savoy. A fection of the gland in this morbid ftate fhews a number of cells formed, containing a vifcid tranfparent fluid. The fize of thefe cells is various in different cafes, but

moſt of them are under that of a pea.   This
viſcid fluid becomes changed by ſtagnation into
a jelly.   Thus a morbid and increaſed ſecretion of
the gland is the cauſe of the diſeaſe.

Symptoms.

Bronchocele is particularly diſtinguiſhed by its
ſlow growth, by the particular ſize to which it is
capable of ariſing, by its want of pain, by its
occurrence in early life, by the firm ſenſation it
yields to the touch, and by its having no influence
on the general health.

DCCXIII.
Schirrus of the Thyroid Gland.

The thyroid gland is the ſeat, at times, of
ſchirrus, by which it enlarges in ſize to ſome ex-
tent, being alſo hard to the feel.   On cutting into
it, this conſiſts of a ſolid whitiſh brown ſubſtance,
with little appearance of cellular ſtructure.   It is
often produced by ulceration of the æſophagus,
particularly at its upper end, extending to the
gland, though it occurs alſo without this affection
extending to it.

Symptoms.

Schirrus here is diſtinguiſhed by its degree of
hardneſs, attended with occaſional darting pain
by its leſſer ſize than in bronchocele, and by the
advanced period of life at which its attack is
made.

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DCCXIV.
Offification of the Thyroid Gland.

The converfion of this gland into offeous matter is generally partial. It takes place only in very old people, and is a rare difeafe. No particular confequences therefore follow this morbid ftate, unlefs it fhould prove fo large as to communicate irritation to the larynx or trachea.

Symptoms.

This ftate of the gland can only be known by accurate examination. If external, it will be eafily afcertained. If more internal, its nature muft remain fomewhat doubtful.

DCCXV.
Offification of the Laryngeal Cartilages.

This is an affection met with from the middle to an advanced period of life. It is connected with the former affection, and the bony difpofition of the gland extends in its progrefs to the larynx. Affuming the nature of bone, the cartilages are liable to its changes, fuffering exfoliation, and being thrown out by an effort of coughing; but this procefs of exfoliation is extremely rare, though it has been known to occur.

Symptoms.

The chief marks of this ftate are denoted by the change of the voice, which becomes either rough and hoarfe, or changed into a whifper from the want of pliancy in the organ. The ligaments

remain in their natural ftate; but by this change
the power of fwallowing becomes loft, and death
enfues from this caufe.

DCCXVI.
Ulceration of the Larynx.

The inflammation of the larynx is apt to ter-
minate in fuppuration, and the feat of the latter
is the facculi laryngis. Ulceration becomes a con-
fequence, which fhews, by the thickening of the
furrounding parts, a fcrofulous difpofition.

Symptoms.

The fymptoms of this affection are fixed pain
in the fituation of the larynx, dyfpnæa, change of
voice, and fymptomatic fever.

DCCXVII.
Inflammation of the Trachea.

This ftate is marked by its increafed vafcularity,
and its changing its natural white pulpy appear-
ance. The confequence of this is an increafed
fecretion, as its cavity is filled with mucous fluid,
occafionally with pus, both fluids containing glo-
bules of air. This is its fituation in cattarrh; and
in the advanced ftages of confumption, along with
hoarfenefs, from a fimilar ftate of the larynx, and
forenefs along the trachea.

Symptoms.

The general fymptoms of cattarrh mark this
ftate; and when the forenefs extends down the
middle of the cheft, the inner tracheal membrane

is inflamed. The subsiding of the inflammation does not for some time remove the increased secretion. The inflammation in consumptive cases is chronic, and long continued.

DCCXVIII.
Morbid Lining of the Trachea.

In some few diseases there is an appearance of a yellowish and pulpy matter, which is supposed to be owing to an increased quantity of mucus, and that dried upon the trachea, and which appears in the form of a membrane. But it is doubtful whether it is owing to mucus, or we are rather to consider it as a crust formed by an inflammatory exudation, just as in the peritonæum or pleura there is discharged a liquor which gradually inspissates and forms a crust of the lymphatic part of the blood; and upon exposing the blood in the trachea to ardent spirits, it gets a considerable degree of hardness, while we do not observe so great a change produced upon mucus by such an addition.

In some of these diseases, a few authors have considered the crust as the cause of the disease, though it is rather to be viewed as the effect; and though we could remove the crust by a wish, we could not cure the patient, nor does the danger depend upon the incrustation. In children dying of the croup, the passage for the air is not intercepted by the membrane. These membranes may

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feparate from the trachea, and be a caufe of much uneafinefs; and it may happen that in collecting they may ftick in the larynx and fuffocate the patient; but they are no more the caufe of the difeafe than a furred tongue in a fever is to be confidered as the caufe of the fever.

Symptoms.

The fymptoms of croup with which this appearance is attended, are difficult refpiration, ftridulous wheezing, cough, hoarfe voice, general fever, with the occafional expectoration of pus, and a whitifh membrane.

DCCXIX.

Tracheal Polypus.

A layer of coagulable lymph is found often to line the internal furface of the trachea and its branches, without any other morbid appearance affecting the membrane. This affection fhews no marks of inflammation, and is of long continuance. At other times, a more folid fubftance fills the fame fituation. In both cafes the veffels feem to difplay a peculiar action in feparating the coagulable lymph, which is coughed up in a tubular form, and has been termed a polypus.

Symptoms.

The marks of this affection are difficult breathing, a dry cough, an increafed pulfe, without any attending figns of inflammation, and, at times, pieces of the polypus coughed up.

DCCXX.

Tracheal Schirrus.

By this affection the paffage of the trachea is narrowed, its fubftance thickened, and its inner membrane formed into hard tubercles. Along with this, fwelling of the neighbouring lymphatic glands is confpicuous.

Symptoms.

The marks of this ftate cannot be certainly determined, for the fame fymptoms will attend as mark fome of the preceding affections.

DCCXXI.

Offification of the Tracheal Rings.

This ftate will be little attended to when flight; but, when fo confiderable as to affect the functions of the part by leffening the flexibility of the membrane, its cavity will not contract in the neceffary degree. The air and mucus form the pulmonary cavity.

Symptoms.

The accumulation of mucus, or rather its difficult difcharge, will be the only leading mark of this morbid affection.

DCCXXII.

Ulcer of the Trachea.

The trachea, like other paffages, is liable to ulceration, though this moft frequently fpreads from the æfophagus to it, and the difeafe falls to be confidered under the æfophagus.

DCCXXIII.

Aphthous Æsophagus.

A layer of coagulable lymph is found to extend from the mouth over the æsophagus, and even to occupy the alimentary canal. This appearance forms what is named aphthæ. An increafed vaſcularity attends it, though lefs confpicuous in the æfophagus than in the other parts, and it generally difappears after death.

Symptoms.

The fymptoms of this affeċtion are known by the appearance of the mouth.

DCCXXIV.

Spaſm of the Æfophagus.

Irregular contraċtion of its mufcular fibres at a particular part, is common in hyfterical patients, which continues after death, and gives a hardneſs of feel. This may accordingly, often repeated, lay the foundation of permanent difeafe, and excite inflammation fo as to terminate in fome of its fecondary confequences.

Symptoms.

This ftate is marked by occafional difficulty of fwallowing, fudden in its attack, and fudden in its remiffion; neither is there any change of the general health.

DCCXXV.

Partial Striċture of the Æfophagus.

A narrownefs of this canal at a particular place,

is fometimes formed by a puckering of the inner membrane to fuch a degree as hardly to allow a pea to pafs; and no other attending morbid change feems connected with it, to account for the altered organization. This affection is flow in its progrefs for a period of years.

Symptoms.

The conftant difficulty of fwallowing, and the long period of its duration, are the only leading fymptoms of this complaint.

DCCXXVI.

Ulcerated Stricture of the Æfophagus.

Ulceration of the æfophagus is the moft common morbid change confpicuous in this part, and it is generally preceded by its fchirrous ftate, confequently, by a thickening of the fubftance to a greater or lefs extent. This thickening is either of a hard uniform fubftance, or of a membranous griftly nature. By this circumftance a contraction of the paffage is induced, and often an almoft total obliteration takes place. The moft frequent points of ulceration are the upper and lower parts of the æfophagus, from the arrangement of their mufcular fibres rendering them more liable to be affected by irritation. Ulcerations here, however, are generally induced by no apparent caufe; and, when affecting the upper part, they extend to the thyroid gland, which affumes the fchirrous, and afterwards the ulcerated ftate.

Symptcms.

This difeafe is marked by its gradual progrefs. The difficulty of fwallowing, at firft flight, gradually increafes. In the advancement of the difeafe the food becomes rejected, and there is feen along with it the occafional appearance of pus. The pulfe is increafed, emaciation takes place to an extreme degree; the neighbouring parts, from irritation, fhew an increafed difcharge; hence cough and hawking arifes. Little nourifhment is received, and yet the fenfe of hunger is not great.

DCCXXVII.

Cartilaginous Æfophagus.

The converfion of the æfophagus into cartilage is only very partial, and may be confidered as a greater degree of fchirrous or griftly hardnefs in a particular point.

Symptoms.

The fame fymptoms diftinguifh it as fchirrus before ulceration.

DCCXXVIII.

Fungous Pharynx.

Fungofity of the pharynx, to a certain extent, though rare, has been met with. On diffection it difplays a fibrous ftructure, with its furface more or lefs ulcerated. A fcrofulous tumor has been obferved in the fame fituation.

Symptoms.

The fymptoms are much the fame as thofe of
the æfophagus.

DCCXXIX.
Dilated Pharynx.

A dilatation of the lower end of the pharynx,
forming a pouch, occafionally appears where a
nucleus firft gives a predifpofition to it, by form-
ing a fmall bed. Thus it has arifen from the
ftoppage of a cherry-ftone at this part, which,
though removed in a few days, left a fmall cavity.
By this occafion was given for the conftant refting
of the food in future there; and the fubfequent
change was of courfe a gradual confequence.

Symptoms.

The only marks of this ftate are the difficulty
of food paffing into the æfophagus, and at laft
becoming fo difficult as to deftroy the patient.

DCCXXX.
Vena Azygos enlarged.

This vein has been occafionally known to be
varicofe, and alfo a rupture of it to take place.

Symptoms.

No external marks, however, can give evidence
of this ftate.

DCCXXXI.
Enlarged Thoracic Duct.

The chief morbid change on this part is its
varicofe ftate, and without any other appearance

of difeafe. This can be known by no external fymptoms.

DCCXXXII.
Obftructed Thoracic Duct.

An obftruction of the thoracic duct has been feen by the depofition of an earthy matter in it. It is only partial, and by its branches the nourifh-ment is ftill conveyed to the fyftem. Rupture of it, though a rare occurrence, has been alfo known.

DCCXXXIII.
Afcitic Abdomen.

Dropfy of the abdominal cavity is more frequent than elfewhere, and appears at every age, and in both fexes. Middle and advanced life are its meft common times of attack.

By the diftention of the abdominal cavity, the fuperficial veins are feen turgid with blood, the fkin of the navel is protruded and yields to preffure, though this is not a conftant fymptom. On open-ing the cavity of the abdomen, the aqueous fluid difcovered is of a brownifh colour, though vary-ing according to circumftances. An affection of the liver gives it a yellowifh or greenifh hue. At times, alfo, it is of a chocolate or coffee colour. Where no difeafed vifcera attend, the morbid accumulation refembles the ferum both in colour and properties. The accumulation of the abdo-men often produces contraction of the inteftinal canal. The liver, or fome of the other vifcera in a

fchirrous ftate, is commonly connected with acites, though not always. Accumulation of water, alfo, in the other cavities, is frequently confpicuous, particularly in the cheft and lower extremities.

Symptoms.

The fymptoms of afcites are, a diftended fluctuation on applying the hand to the belly and ftriking it with the other, paucity of urine and high coloured thirft, and fenfe of heat, with fome frequency of pulfe. In the advanced ftage refpiration is impeded.

DCCXXXIV.

Inflamed Peritonæum.

The peritonæum is lefs fubject to inflammation than the pleura, and it occurs at times in both fexes, though women after parturition are peculiarly predifpofed to it. The inflamed peritonæum appears thick, pulpy, and lefs tranfparent, with an increafed vafcularity. The inflammation never extends to the mufcles, but it affects the inteftinal canal, and penetrates through the coats of the bowels.

The extent of peritonæal inflammation varies, being at one time flight and partial, at another great, and general over its furface. When chiefly affecting the inteftinal divifion, broad bands of inflammation are formed, which obferve the courfe of the inteftines, and are formed by the contact of the different inteftinal portions ; and the inteftines,

when examined, are no way thickened in their texture by the progrefs of the inflammation; but, where the inflammation is evident, the inteftines acquire a thicknefs and maffy feel, in confequence of increafed action of veffels and extravafation. The peritonæal appendages, or the mefentery and mefocolon, are much thickened, as well as the omentum; and this may be afcribed to the extravafation of coagulable lymph that takes place to this cellular fubftance. Befides thefe changes, different portions of the vifcera are often glued together by a yellowifh pulpy matter, varying in its degree of thicknefs in different cafes by the coagulable lymph of the blood; and with this there is effufed a brownifh fluid in the cavity of the abdomen, of a ferous nature, mixed with threads of coagulable lymph, and occafionally pus, by which it is rendered turbid. Thefe extra-vafations often extend in proportion to the ap-parent degree of inflammation. Pus and air are alfo part of the collection met with here, the latter being moft common in flight cafes.

Symptoms.

The marks of peritoneal inflammation, are pain of the abdomen, with fome fwelling, and much forenefs to the touch. The pulfe is increafed and hard, with other general marks of fever, and moft commonly coftivenefs. In flight cafes, the fymp-toms are often hardly perceptible, and hence the

difeafe is found highly infidious, and its true nature only difcovered by diffection.

DCCXXXV.

Abdominal Adhefions.

The effect of peritonæal inflammation, where not fatal, and much coagulable lymph is thrown out, is to form a fine tranfparent membrane, which is the medium of adhefion.   This procefs foon takes place, and the membrane poffeffes the fame appearance as cellular membrane in other parts, and poffeffes a fufficient fhare of vafcularity. Hence it can be injected, and fhows alfo a rednefs when inflamed.   This membrane alfo elongates with the action of the vifcera; and though joining them together more or lefs, it is attended on that account with lefs inconvenience than might be fuppofed.

Symptoms.

No peculiar fymptoms attend the prefence of adhefion.

DCCXXXVI.

Scrofulous Accumulation on the Peritonæum.

A white, foft, granulated matter, appears at times behind the peritonæum, and feems very univerfally extended, formed in one large thick mafs, or in fmall ones.   The omentum feems entirely changed into this fubftance.   The morbid change feems to refemble that of the abforbent glands in other fituations.

Symptoms.

This appearance is marked by no peculiar symptoms.

DCCXXXVII.

Cancer of the Peritonæum.

Small cancerous tumors are found at times adhering to the peritonæum, hard and white in their structure, and occupying that part in the region of the stomach. This cannot be traced by any certain marks. Scrofulous tumors have been also observed here.

DCCXXXVIII.

Abdominal Hydatids.

Abdominal hydatids are found occupying the whole of the cavity. They are connected with some of the viscera, to which they owe their formation; and they particularly proceed from the state of the liver and spleen.

Symptoms.

This disease is to be distinguished from ascites by an indistinct fluctuation, on examining as in ascites; or by none at all, by the commencement of swelling in a fixed point, from which it becomes diffused. From ovarial dropsy it is distinguished by the latter commencing in the side, and gradually extending from that over the abdomen, while, in hydatids, the swelling is from the upper part of the belly, or region of the liver, spreading downwards. This disease, however, may

begin at any part of the belly, which renders all its diftinctions doubtful.

DCCXXXIX.

Abdominal Accumulation of Air.

Air is occafionally collected in the abdomen, without any in the inteftines. The collection, however, is moft common in the inteftines, by which they become diftended, and their coats thinned; and on examining, it is impoffible to fay whether this accumulation takes place in the abdomen or the bowels.

DCCXL.

Morbid Changes of the Stomach.

Inflammation.

General inflammation of the ftomach is always the effect of poifon, and therefore not fo frequent; but partial inflammation is a common occurrence. In the latter cafe, the inflammation is feldom violent. The external furface fhews, at this part, an increafed vafcularity; and on opening the organ, its fubftance is here thickened. The inner membrane acquires confiderable rednefs, with fome degree of bloody extravafation. Common inflammation feldom terminates in pus or gangrene. From arfenical poifon, the moft violent inflammation of this organ takes place. Much rednefs, and thickening of its fubftance, is produced along with bloody extravafation. Part of the inner membrane is alfo occafionally deftroyed, and a thin

layer of coagulable lymph at times thrown out on the furface of the organ. When the fubftance has paffed farther than the ftomach, ulceration of the inteftines has occurred. It has been particularly obferved in the rectum.

Symptoms.

Inflammation of the ftomach is marked by pain in the epigaftric region, increafed on fwallowing, by vomiting, and hiccup, with a frequent fmall hard pulfe, by much heat and thirft, and by an uncommon fenfe of debility. In cafes of arfenic, thefe fymptoms rife to a ftill more violent degree.

DCCXLI.
Hydrophobic Affection of the Stomach.

Diffections of hydrophobic patients fhew the ftomach inflamed at the cardia and great end, and this inflammation feems to defcend from the pharynx and æfophagus. The inflammation is generally of the erifipelatous kind.

Symptoms.

Hydrophobia is peculiarly marked by the morbid averfion at fluids, by the difficulty of fwallowing, and by the ftrong derangement of the mind attending this ftate.

DCCXLII.
Ulcers of the Stomach.

Ulcers of the ftomach occafionally appear on diffection, and they either refemble thofe on other parts of the body, or they appear as if a part

had been cut out with a knife. Thefe ulcers at times only corrode part of the coats, at other times they make a hole in the organ. In the vicinity of this ulcer the coats of the ftomach difplay fometimes a thinnefs, at other times they are thickened, and, on other occafions, they preferve the natural ftate.

Symptoms.

The fymptoms of this affection are, pain of the ftomach and rejection of food, while no plan of treatment gives relief. The difeafe is generally flow in its progrefs.

DCCXLIII.

Schirrus and Cancer of the Stomach.

This difeafe is difplayed chiefly in men in advanced life. Although without predifpofition, intemperance cannot be confidered as its caufe, it then has confiderable influence. Schirrus of this organ is moft commonly partial, and the limits between the difeafed and found part of the organ are generally very diftinctly marked. In partial fchirrus, the pylorus is the part moft affected, from the more glandular nature of its ftructure. By this affection the thicknefs and hardnefs of that part of the organ is increafed; and when cut into, the original ftructure, though ftill diftinct, is altered in appearance by the peritonæal covering acquiring a griftly hardnefs, and the thickened mufcular part being interfected with ftrong mem-

branous fepta; while the inner coat, befides being thick and hard, is towards the gaftric cavity fome-what tuberculated. The ulceration of this changed and thickened texture on the furface conftitutes cancer, and fungus frequently proceeds from pro-cefles of the inner membrane. The organ is, in-deed, often entirely changed into a mafs of a whitifh or brown colour, or converted into a fub-ftance fomewhat cartilaginous. In this morbid flate the neighbouring abforbent glands are enlarged.

Symptoms.

Cancer of the ftomach is attended with pain of the organ, with the rejection of what is taken, and frequently with the vomiting of a coffee-coloured fluid. Emaciation, and fallow counte-nance, are attending fymptoms, with frequency of pulfe, and the formation of hectic. No peculiar fymptoms mark the difeafe where unaccompanied with ulceration.

DCCXLIV.

Small Tumor of the Stomach.

An occafional appearance of fchirrofity, dif-ferent from the former affection, is met with in a fmall tumor the fize of a walnut, while the reft of the organ is entirely in a healthy flate. What effects this tumor may have under the influence of irritation in difordering the functions of the organ, have not been afcertained. Mechanical means may produce a preternatural cavity in the ftomach,

or a pouch.   Where that occurs, the coats of it are thinner.

DCCXLV.
Stricture of the Pylorus.

Stricture of the pylorus oftener occurs than at the cardia, as the fibres poffefs ftronger powers of contraction; and it has been found fo great as hardly to admit a goofe quill to pafs from the ftomach into the duodenum.

Symptoms.

The chief fymptoms of this ftate will be the rejection of every thing taken, and fixed pain in that part; while the body, from being deprived of its nourifhment, foon declines.

DCCXLVI.
Altered Capacity of the Stomach.

The ftomach is fometimes fo contracted as not to exceed the fize of a fmall inteftine, and on other occafions its dimenfions are equally enlarged. Thefe appearances are not the effect of difeafe, but depend on an irregular contraction or relaxation of the mufcular fibres at the period of dif-folution.   The ftate of dilatation is moft frequent.

DCCXLVII.
Diftenfion of the Stomach.

Though generally flaccid and empty at death, this organ is alfo found occafionally diftended with air, and this air is commonly extricated from the contents of the ftomach, or from its circulation.

Symptoms.

The symptoms of this state are external swelling of the epigastric region, with a sense of distention and wind passing up by the œsophagus; occasional pains also occur in the stomach, the effect of spasm.

DCCXLVIII.

Solution of the Stomach.

On examining the great end of the stomach after death, from the action of the gastric fluid, there its coats appear thin, transparent, and pulpy; and at times the stomach has been completely dissolved by the same cause, and its contents effused into the abdomen. In the same way it is known to act on the neighbouring viscera, which suffer a partial solution. This effect only happens in those who have died in health, and whose stomachs have not been impaired by disease.

Fatty tumours, biliary calculi, and pustular appearances, are also met with, though very rarely, on examining the stomach after death.

DCCXLIX.

Morbid Changes of the Intestines.

Inflammation.

A variety of causes induce inflammation here; and the appearance which such inflammation produces is, first, an increased vascularity of its surface, which extends also through all its coats, being frequently attended with bloody extravasa-
While the intestine is thus altered, the

peritonæum is often little affected; but, at other times, it is alfo inflamed, and covered with co-agulable lymph, which is frequently thrown out upon the furface of the villous membrane. In more violent cafes, the inteftine receives an additional thicknefs and weight, with its colour much darkened from extravafation, fo as almoft to re-femble gangrene.

Inflammation of the inteftine commonly paffes into a fecondary ftage, or fuppuration, and ul-ceration, particularly where the inflammation at-tacks the internal membrane; and this fecondary ftate never commences on the external membrane. The great inteftines are more fubject to this ter-mination of it than the fmall ones.

Ulceration of the inteftines is attended with confiderable variety in its appearance, difplaying at one time a thickened ragged edge, at other times being little changed from the internal ap-pearance, and fometimes fmooth, as if a fection had been made with a knife. In the progrefs, the inner membrane hangs frequently in fhreds, or is ftripped entirely from the inteftine, leaving the mufcular furface bare. Ulceration of the inteftine either terminates by erofion, fo that the inteftinal contents pafs into the abdominal cavity, or adhe-fion is formed by the ulcerative inflammation to fome neighbouring part, and thus a new commu-nication or paffage is eftablifhed. Such commu-

nication is generally the means of fupporting life longer than otherwife.

From its peculiar fecretion and ftructure, the inner inteftinal membrane is more fubject to ul-ceration than any other in the body. But, inftead of ulceration, a more common termination of in-teftinal inflammation is by gangrene, the part af-fuming a black livid colour, and lofing all tenacity, which is the chief mark, more than the colour, of this ftate.ʹ The confequence of gangrene here, is the formation and accumulation of a confiderable quantity of air in the inteftinal cavity. The gan-grenous part, when completely mortified, has been known to feparate from the reft, and, though fatal in the event, to be expelled by the anus.

Symptoms.

Inflammation of the inteftines is known by acute abdominal pain, vomiting and coftivenefs, with heat and thirft. The pulfe here is generally frequent, fmall, and hard.

DCCL.

Intuf-fufception of the Inteftines.

This affection confifts in the paffage of one portion of the gut within another for fome length, dragging after it its part of the mefentery ; and the received portion is commonly in a contracted ftate, being, for the moft part, an upper portion falling into an under one; though this is not the cafe. The moft frequent fort of in-

tuf-fufception is the fmall inteftine, particularly
where the ilium terminates in the colon. Intuf-
fufception is fometimes difentangled by the natural
periltaltic action, but more frequently from the
degree of inflammation the parts thicken, and are
glued by adhefions producing fatal obftruction of
the paffage of the inteftine.

Symptoms.

Intuf-fufception, in its advanced ftage, is marked
by the fame fymptoms as inteftinal inflammation ;
but, from the ftate of the parts, and their form-
ing adhefions in confequence of inflammation, it
is more fatal.

DCCLI.

Concretions.

Several concretions are met with in the intef-
tines, and they are by no means a rare occur-
rence. Moft of them have nuclei, and we may
fuppofe them in others, where they feem to be
wanting ; for we can imagine a clot of blood to
ferve as a nucleus which may afterwards fhrink,
fo that we can fcarcely perceive it on cutting
the ball. In order to give fome kind of idea of
one way in which fuch balls may be formed, we
perceive in balls taken from the ftomach of a cow,
that they are plainly compofed of hairs that are
always of the fame colour with thofe on the fur-
face, and thefe are formed by the animal licking
itfelf ; the hairs are determined to the throat part.

by the rugæ of the mouth, &c. and fo come to be
collected in the ftomach. In like manner we may
imagine concretions formed within ourfelves, but we
are not to imagine that the undigefted and fibrous
part of the aliment alone forms the concretions, there
may be fuch an attraction of the nucleus to parts
of the aliment as takes place in the vefica urinaria:
fo within our alimentary canal are found the in-
crufted feeds of goofeberries, and feveral concre-
tions which refemble gall ftones, or fuch con-
cretions as are found in the falivary ducts. If we
fuppofe thefe to form in the ftomach, yet they
fcarcely ftop till they come very low, and are moft
frequently found in the great inteftines, particu-
larly in the beginning of the colon, in the caput
coli more efpecially, or in the caput cæcum coli,
where they are very much out of the circulation
of the food, and the caput coli is fometimes found
at the fame time of very confiderable fize.

Symptoms.

We could judge of this difeafe, if a perfon,
without feeming to have any great weaknefs in
the ftomach, or being fubject to nervous com-
plaints, has a frequent pain. If this is fituated in
one particular part of the inteftines, and remains
there for a confiderable time, if it comes in an
uncertain manner, without the patient being able
find a caufe, that no error is committed in diet;
e time, perhaps, the patient has a loofe belly,

at another time there is a total ftoppage, and that made mechanically, by the ball blocking up the paffage ; foon after which there is perhaps a great difcharge of the fœces, and that not without a great deal of pain ; and we diftinguifh particularly a ball of this kind, by the patient feeling a pain upon preffing upon the part, and we can difcover a remaikable hardnefs. If we find that this has very much changed its place, or is fituated where no folid bowel is to be found, were it under the left ribs, we might apprehend that it was the point of the fpleen in a fchirrous ftate ; whereas, if we find it at the fide of the umbilicus, we would conclude that it is owing to fuch a con-cretion.

DCCLII.

When a ball of this kind has refted long in one place, by inflammation and irritation the coats of the gut are thickened ; and the fame caufe acting, the gut is conftricted, though the diameter of the ball is not at firft greater than that of the gut : in confequence of this conftriction in it, it comes to be impoffible for the ball to pafs, and there comes to be an adhæfion to the containing parts of the belly.

DCCLIII.
Worms.

Next, we meet with different kinds of worms, viz. the tape worm and the ground worm. It has

been imagined that the tape worm was a chain of animals totally diftinct from each other. Of ground worms, connected by tenacuia; but, by injecting the tape worm, there is a real communication between its joints, fo that the whole joints make but one animal, but every joint is at the fame time capable of living, as being provided with a mouth, but they live beft when connected; for, fuppofe that fome joints do not receive proper aliment, they can receive the nourifhment from the fuperior joints.

DCCLIV.

It has been imagined that it is in a continual ftate of growing, by frefh additions to the number of joints; but we have no proof of this; and the only queftion is, Whether the pieces when joined, have at the end one piece different from the reft, by which the animal lays hold of the inteftines? and Dr. Tyffon has in a great meafure proved this.

DCCLV.

Next, the *lumbricus*, which is effentially and totally different from the earth worm. This is more eafily expelled, but it is more dangerous than the former, as preying not only upon the contents, but on the coats of the inteftines, eroding great portions of the villous coat. Here, indeed, it generally ftops, the other coats refifting it from their greater hardnefs, and containing lefs of its nourifhment; but, in fome cafes, thefe too

are found eroded and perforated, and we are not to conceive that this happens after death when the animal is uneafy, and wants to efcape, for we have inftances where this worm has made its way through abfceffes.

DCCLVI.

Next, the *afcaris*, which appears only a young lumbricus, and not a diftinct fpecies. It has been reprefented as having two heads, as it burfts from the corrugation occafioned by its being kept in fpirits, but in fhape it approaches near to the lumbricus, and we have found them exifting at the fame time.

DCCLVII.

Ruptures, or Inteftinal Difplacement.

A portion of the abdominal vifcera is frequently carried out of the cavity from fome fudden violent exertion, and lodged in a fac of elongated peri-tonæum, forming what is termed a rupture. This difeafe is fo frequent, that one out of every eleven is calculated to labour under it; and though every part of the abdominal contents may be occafionally difplaced in this way, the omentum and inteftines are moft frequently fo. The moft common places of this difplacement, are the rings of the muf-cles of the abdomen where the fpermatic chord paffes, and the round ligament in the female, or behind that ring at the lower edge of the external oblique, where the veffels pafs down to the thigh.

The bowels that will moſt readily fall out, are;

1. The turns of the inteſtinum ilium, the meſentery lengthening as we go downwards, ſo that, beſides the end of the ilium being nearer to the ring, the meſentery is longer.

2. The omentum, which is the part moſt frequently found in the hernial ſac, and it may carry along with it the large and looſe arch of the colon.

3. The great ſac of the colon may fall down from the weight of the fœces puſhing it gradually lower down, and bringing it nearer to the rings of the muſcles as life advances, ſo that elderly people are particularly ſubject to this complaint.

When the omentum has remained long in the ſac, it forms a pretty compact maſs, for the moſt part, though not always adhering to the inner ſurface of the ſac; and, though occaſionally without inflammation, at other times it is ſo violent as to produce gangrene.

Along with the omentum, a portion of the inteſtine is often lodged in the ſac, and often the inteſtine is lodged itſelf, without any omentum. The ſize of the portion varies in different caſes; and where the functions come to be interrupted by the preſſure of the ring, or opening of the ſac, ſo as to induce inflammation, the diſeaſe often ends fatally.

The appearances of inflammation here are the ſame as formerly deſcribed; and its aſſuming the

ftate of gangrene is marked by its deep and livid colour, by its want of tenacity, and its diftenfion with air. When the inflammation terminates favourably, ftill adhefions form, which attach the gut for ever after to the inner furface of the fac.

The fac, or containing part, when firft defcending, is a thin opake membrane, of a firm texture, and white colour, being merely the peritonæum fomewhat thickened by preffure. In cafes, however, of long ftanding, its ftructure becomes changed; and, in confequence of thickening, it is divifible into feveral layers. Internally, its furface is fmooth, and is extended from the inner coat of the peritonæum. Externally, the furface is rough and irregular, and, at the ring, it poffeffes a narrow neck, correfponding to the fituation of the parts.

Symptoms.

Rupture is marked by a pale fwelling at the feat of the difplacement, with a flight occafional pain in it, diffufed over the belly, and the fwelling protruding with every exertion; by its difappearance in the horizontal pofture, and its admitting being puſhed up, though not always when of long ftanding.

DCCLVIII.

In the ftage of ftrangulation, to thefe general fymptoms are to be added thofe of inflammation, or moft diftreffing ficknefs, vomiting, obftinate

coftivenefs, with heat, thirft, and frequent fmall
hard pulfe, ending in hiccup, and the appearance
of yellow fœtid matter from the mouth.   In fome
cafes, however, the pulfe is little increafed.

DCCLIX.
Congenital Rupture

Differs from the other in the fac being the
fame with that of the tefticles, arifing from the
opening at the ring not clofing at birth, after the
defcent of the tefticles, and a portion of the in-
teftine, or omentum, falling into the elongated
portion of the peritonæum.

Symptoms.

The chief mark of this fpecies, is its appearance
coëval with birth.

DCCLX.
Schirrus and Cancer of the Inteftines.

This affection is moft frequent in the large in-
teftines in advanced life, and its moft common
feat is the figmoid plexus of the colon or rectum ;
and this proceeds from the greater glandular ftruc-
ture, and the narrownefs of the gut at the former
part.   The difeafe is commonly here very circum-
fcribed, though it has been known to extend fome
inches ; and it differs in nothing from the appear-
ance affumed by the ftomach under the fame dif-
eafe.   The coats acquire a thicknefs and hardnefs ;
the internal one, efpecially, is formed into hard
irregular folds, and they are in general divided by

membranous fepta. The ulceration of the inner furface, in this ftate, produces cancer; and, in the advanced ftage of the malady, the ftructure of the gut is changed into a griftly hardnefs. The confequence of fchirrus is a contraction of the paffage of the gut, which becomes at times almoft obliterated; and above this contraction, it is enlarged in the fame proportion from the accumulation that neceffarily takes place. Another confequence of this affection, is the formation of adhefions between it and the neighbouring vifcera, occafioning ulceration to fpread.

Symptoms.

The progrefs of this difeafe is at firft flow, and there is little pain in the part, the patient only obferving a coftivenefs, and fome difficulty in the paffage of the ftools. In time, pain comes to be felt in the part on ftool, after which it becomes relieved. In the ftools, pus and blood is occafionally mixed, efpecially towards the termination of the malady. The fallow countenance is here a leading mark of the difeafe, with much general debility and quicknefs of pulfe. The conftitution gradually failing, the patient is at laft cut off.

DCCLXI.
Dyfenteric Inteftine.

The gut is here confiderably thickened with irregular tubercles of a white or yellowish colour, and frequently there appears an abrafion of the

inner membrane. But the moft frequent appear-ance in fatal dyfentery is increafed vafculatity and ulceration of the inner membrane.

Symptoms.

The fymptoms of dyfentery are griping, and often moit acute pains of the belly, frequent evacuations of various matters, as mucus, pus, blood, membranous fibres, white lumps, and hardened fœces. Tenefmus is a conftant fymptom after ftool, and there is frequently more or lefs general fever.

DCCLXII.

Thickened Rugated Membrane.

This appearance confifting in the great inteftine formed into broad thick folds, containing an accumulation of blood, is a rare occurrence. On examination, it is found an accumulation of cellular matter behind the gut. Above the anus, alfo, little proceffes fometimes grow from the inner membrane, forming a circle acrofs the gut.

Symptoms.

Thefe changes are diftinguifhed by no peculiar external marks.

DCCLXIII.

Piles.

Piles and ulcerations of the anus are common difeafes. The former are foft tumors of various fhapes, fituated round the verge of the anus, covered with a fine fkin, partly derived from the

external covering of the anus, and partly from the inner membrane of the gut. Though entire, through thefe tumors much blood is often dif-charged, and they confilt of the veins round the anus much enlarged.

Such tumors alfo form within the rectum, termed internal piles, occafioned by an enlarge-ment of the veins, frequent in advanced life, which is the common period of their attack. They are the effect of long continued obftruction to the return of the blood from the rectum. On this account they are more frequent in women than in men, in confequence of fuch obftruction laid by pregnancy, and from the greater tendency in women to coftivenefs from their mode of life.

Symptoms.

Piles are eafily known by external fwellings at the anus, or within the rectum, by pain in their feat on the paffage of the fœces, by an occafion il flow of blood, and fenfe of irritation in the part; and thefe local fymptoms are often preceded by conftitutional fymptoms of turgefcence, as giddi-nefs, dyfpnœa, colic, and lumbar pains.

DCCLXIV.
Fiftula.

Fiftulæ are feated at the lower end of the rectum. They are narrow canals, with a fmooth internal furface, poffeffing a purulent fecretion, and terminating externally by a callous edge. The

canal is either fingle, or divided into branches. It has an external opening by the fide of the anus, frequently a fmall one into the gut, and at times one at both extremities. The firft, however, is moft common.

Symptoms.

No external fymptoms mark this difeafe.

DCCLXV.

Malconformation of the Rectum.

Some inftances of the malconformation of the rectum occur by its terminating in a third fac, without any external opening; and on perfora- tion of the part, the end of the gut is found at fome diftance. The ftrong tendency of the parts to contract afterwards, is always againft the fuc- cefs of an operation.

In the fame way the rectum is known, at times, to terminate in the bladder, which admits no re- lief; and occafionally, though rare, in the vagina.

DCCLXVI.

Worms.

Worms occupy the inteftines of man, as well as thofe of other animals; and they are confined, as already noticed, to three fpecies, the lumbricus teres, the tenia, and the afcaris.

Symptoms.

The fymptoms attending the prefence of worms here, are fwelling of the belly, offenfive breath, emaciation of the extremities, and deranged ap-

petite, with picking of the nofe, and grinding of the teeth in fleep.   Thus the appetite is at times very great, at other times very fmall, and the ftools are generally flimy.

The fymptoms of the tenia are, a gnawing in the region of the ftomach, leffened or removed by eating, irregular appetite, as in the former, itching of the nofe and giddinefs, naufea, and cholic ; at times, cough and convulfions.

The marks of afcarides are, uneafy feeling of the rectum, and itching of the anus ; with heat, tenefmus, and mucous ftools mixed with blood or afcarides.

DCCLXVII.
Accumulation of Air.

An accumulation of air in the inteftines is attended with flight peritonæal inflammation ; and the inteftinal veffels are frequently filled with it. This either arifes from the contents of thefe parts being extricated by the procefs of digeftion, or it is fecreted by the veffels, and poured out here, which is more probable, as being found to confift moftly of carbonic acid gas.

Symptoms.

The marks of this accumulation are, fome abdominal fwelling, often fhifting its place, and attended with a kind of gurgling noife, coftivenefs, and occafional cholic.   When largely accumulated, it forms tympany, known by the tenfe elaftic feeling

of the fwelling, by fome dyfpnæa, by fevere cholic and coftivenefs, and by occafional difcharge of flatus both upwards and downwards.

DCCLXVIII.

Offeous Accumulation.

An offeous matter has been at times feen thrown out upon the furface of the inner membrane of the gut; and even an adhefion of the inteftine, in two points, has been feen converted into bone. Thus an offeous matter is capable of being depofited by fecretion in any part of the body. Calculous matter has been alfo mentioned as occafionally occurring in the inteftines.

DCCLXIX.

Inflamed Mefentery.

This is generally conjoined with that of the peritonæum; and under inflammation the mefentery becomes thick and maffy, and its large veffels are much obfcured from the extravafation of coagulable lymph, while the vafcularity of the adjacent peritonæum is increafed.

Pus is occafionally found on the mefenteric furface, and abfceffes between its layers; but thefe circumftances are rather uncommon. It feldom extends beyond fimple inflammation, except where gangrene of the inteftines occurs, and it partakes in the fame ftate.

Symptoms.

The fymptoms of this affection are the fame
8

with thofe of the peritonæum, and cannot be dif-
joined.

DCCLXX.

Morbid State of the Mefenteric Glands.

The mefenteric glands are apt to affume three
different fpecies of morbid difpofition, viz. a fcro-
fulous, cancerous, and earthy one.

1. The firft is moft frequent in children, where
they become enlarged in fize, and fomewhat fofter
than natural to the touch, difplaying, on dif-
fection, either the natural ftructure, or a change
in part into a white, foft, curdy matter, not un-
commonly mixed with pus.

2. The fecond differs nothing in appearance
from fchirrus elfewhere, and is commonly the
confequence of a cancerous affection of the in-
teftines.

3. The third is an accumulation of earthy or
offeous matter in the glands, which is, indeed, a
rare occurrence, compared with its appearance in
thofe of the lungs.

Symptoms.

The marks of enlarged mefenteric glands are, a
fwelled belly, and emaciation of the extremitics,
with the conftitutional appearance of fcrofula, and
ro traces of worms.

Hydatids and fatty tumors attached to the me-
fentery are rare appearances, though they have
been enumerated.

DCCLXXI.

Morbid Changes of the Liver.

External Membrane inflamed.

This affection is often conjoined with that of the peritonæum. It occurs, however, without this connection; and though it spreads, at times, over the whole of the organ, yet it more commonly affects only its anterior convex part, sometimes the side next the stomach and duodenum. The appearances here are the same as in the peritonæum, an increased vascularity occurs, and also a thickness of its substance, with a layer of coagulable lymph thrown out, differing in thickness in different cases, and glueing the organ more or less to the adjacent parts. A serous fluid is also sometimes effused.

Symptoms.

The symptoms are much the same with those of pleurisy, acute pain of the lower part of the right side, dyspnæa, cough, and symptomatic fever.

DCCLXXII.

Adhesion.

The consequence of hepatic inflammation is the forming adhesions, which arises from the organization of the coagulable lymph thrown out. This organization forms it into a thin transparent membrane, which connects the organ with the adjacent parts. This connection is either general over the surface, or consists of different small processes.

The mode of adhefion is occafionally by a long membrane, at other times by a clofe attachment. The anterior part of the liver is the moft common feat of thofe attachments. In cafes of adults, thofe adhefions prevent the diffufion of pus in the abdomen. The pofterior part of the liver is, at times, connected to the ftomach and duodenum, and adhefion there will have a fimilar effect as in the former cafe of abfcefs.

Symptoms.

No peculiar external fymptoms lead to a know-ledge of adhefions.

DCCLXXIII.

The coats of the liver fuffer, at times, a partial converfion into cartilage, which is fmooth, thin, and of a foftifh texture. This, however, is a rare circumftance, and can be previoufly afcertained by no fymptoms.

DCCLXXIV.

Inflammation of the Liver.

This affection is peculiar almoft to a warm climate, while that of its coats occurs in a cold one. This inflammation of the organ is attended with an enlargement of its fize, and a deep purple colour of its fubftance, with a general jaundiced colour of the fkin. Its outer membrane is not always affected by this ftate of inflammation. The progrefs of this inflammation is to terminate by abfcefs; and this abfcefs is often fo large as to contain fome

pints of matter. Sometimes the whole liver is con-
verted into this containing bag; and the difeafe is
generally accompanied by afcites, the fluid of
which is of a yellow or green colour, from the
tinge of the bile.   Gangrene of the liver is a very
rare occurrence, if ever taking place.

<div align="center">Symptoms.</div>

· Inflammation of the liver is marked by obtufe
pain in the right hypochondrium, rifing to the top
of the fhoulder, by difficult recumbence on the
found fide, by a dry cough, with hiccup and
vomiting, by an occafional jaundiced appearance,
and in general by fymptomatic fever; though,
when flow in its progrefs, both pain and fever
are at times unknown; and its prefence is only
detected by the formation of an abfcefs.

<div align="center">DCCLXXV.</div>

<div align="center">Tubercles.</div>

. A frequent difeafe of the liver is, the formation
of tubercles, efpecially in men from middle to
advanced age who are addicted to excefs in drink;
and thefe tubercles are diffufed generally over the
whole organ, of a rounded fhape, and fituated
near each other.   By this affection, the hepatic
furface is every where irregular, and their dif-
fection exhibits a brownifh or yellowifh white
matter.   Their moft common fize is that of hazel
nuts, though known occafionally as fmall as a pin.
With this irregularity, the liver feels hard

<div align="center">8</div>

to the touch, especially at the lower edge, which
is bent a little forwards. Its size is, however,
generally diminished on the whole; and its vessels,
when it is cut into, shew a lessened diameter.
Its colour is frequently yellow, and water is found
in the abdominal cavity of the same tinge. The
gall bladder is generally contracted, white, and
empty; and the chest is yellow, or suffused with
bile.

<div align="center">Symptoms.</div>

The symptoms of schirrous liver are, pain or
uneasy feeling in its region, continuing long, and
attended at last with jaundice and water in the
abdomen. This state of the organ, at its lower
edge, can at times be felt when the abdominal
accumulation is small.

<div align="center">DCCLXXVI.</div>

Besides this common state of tubercles, other
varieties occur, which are of three kinds, the
white, the brown, and the scrofulous.

1. The first of these, which are rare, equal in
size a chesnut. They are seated most commonly
near its surface, two or three together, while the
intermediate space of the organ is free from dis-
ease. They consist of firm, opake, white sub-
stance, depressed and hollow in the outer parts,
forming as it were round the blood vessels; and,
when they occur, the organ is increased in size
with or without abdominal accumulation; and,

in the fame way, with or without a change of colour.

2. The fecond fpecies of tubercles is, the foft brown, which is not fo large as the former, but occupies the fame fituation, and confifts of a fmooth, foft, brownifh matter.

3. The third fpecies is the fcrofulous tubercle, refembling entirely thofe of the lungs; but this appearance is very rare, and thefe tubercles are difperfed regularly through the fubftance of the liver, without producing any irregularity of its furface. At times, with fuch tumours, the liver is found more flaccid in its fubftance than is natural. In fuch cafes of flaccidity, the liver has been found alfo very foft.

DCCLXXVII.
Morbid Hardnefs.

A general hardened ftate of the liver occafionally appears, which, when cut into, difcovers no other peculiar morbid change. This is confidered by fome as the previous ftage of tubercles.

Symptoms.

Hardnefs of liver is diftinguifhed by no peculiar marks, but there will prevail in its progrefs fome uneafinefs or weight in its region, joined with a fallow appearance of the countenance.

DCCLXXVIII.
Hydatids.

No organ is fo much the feat of hydatids as the

liver and kidneys. In the former, they are con-
tained in a firm cyſt, often of conſiderable ſize,
having externally a cartilaginous feel, and lami-
nated to appearance within, with various degrees
of thickneſs in different caſes. The external ſur-
face of the cyſt conſiſts of a white matter, the
internal of a pulpy ſubſtance, ſimilar to coagulable
lymph. The number of hydatids in a cyſt is
various. They lie loofe in its cavity, ſwimming
in a fluid, or attached to the ſide of the cheſt;
and they are compoſed of a white opake pulpy
matter, having much contractile power, with a
fluid capable of being coagulated; and theſe hyda-
tids contain often within them ſmaller ones, either
looſe or attached to their ſides, as in the larger
ones. Theſe hydatids of the liver are often un-
connected; but, at other times, they ſeem to
incloſe each other. The cyſt is moſt commonly
within the ſubſtance of the liver, though occaſion-
ally attached to its outer ſurface, and hanging from
it into the abdomen.

Symptoms.

No peculiar ſymptoms characteriſe this diſeaſe,
and conjecture can only be made of its exiſtence.
This conjecture is formed by the gradual forma-
tion of a tumor in the region of the liver, by its
having little influence on the general health, by
its giving to the feel a certain ſenſe of ſoftneſs
without fluctuation, or rather an obſcure one, and

by its being traced particularly from the liver as
its origin.

DCCLXXIX.
Offeous Depofitions.

Cyfts containing an earthy matter are at times
to be met with in the liver. The cyft, in this
cafe, is of a cartilaginous confiftence, and its con-
tents are an earthy matter, of a brownish white
colour. This affection can be learnt by no ex-
ternal marks.

DCCLXXX.
Rupture.

Strong preffure upon the liver is found to occa-
fion its rupture; for, inftead of recovering its
former ftate after the removal of the preffure, as
happens to parts of a more elaftic ftructure, the
foftnefs of its texture occafions it to give way.
This accident is attended with little pain; but,
from the derangement of the circulation, death in
a fhort time fucceeds it.

DCCLXXXI.
Worms.

Worms are a rare appearance in the liver,
though they have been noticed here, as well as in
feveral of the other vifcera.

DCCLXXXII.

From this view of the difeafed ftate of the liver,
its organic changes appear numerous, and the fol-
lowing obfervations contain the fum of what claims
attention on the fubject.

DCCLXXXIII.

Veficles we have found in large facs, and with-
in each of the larger we find fmaller. Now, this
appearance, though it occurs moft frequently in
the liver, yet it is to be obferved in various other
places, but efpecially in the abdominal vifcera.
Till within thefe few years, thefe very generally
were taken for portions of cellular fubftance,
formed by concretions of the cellular membrane.
But Dr. Pallas, an ingenious naturalift, con-
ceives that they are animated bodies; which
opinion was firft hinted by Dr. Tyfon in the laft
century; and, upon the whole, his idea is juft,
though in feveral refpects he errs in calling them
tenia hydatidea. He fuppofes that it is an animal
fomewhat like to that in the inteftines, and that
this produces hydatids; but no fuch connection
can be obferved; and it may be doubted that
the tenia is conftantly fending off new joints, or
adding to its number, which is a very difcouraging
opinion; for, after we have feparated hundreds
of joints, it may ftill form new ones; but by kill-
ing joints, we kill a part of the animal, and there
is no growth again. And there is a greater proba-
bility that they are animated fubftances, from our
finding clufters of round bodies within each other
adhering to the outer fkin, which we muft take to
be the parts of the young growing, and that when
they have acquired a certain bulk they feparate;

and the fecond having the fmall ftructure as the
firft, contain others, and fo on *ad infinitum;* and
it only remains to prove that they are living
animals, that we diftinguifh their motions; but
they have no manner of communication with the
cellular fubftance, nor have they veffels painting
them, fo they can only live by fluids poured
in from the arterial fyftem; and we find other
worms in the liver, the origin of which we can
as little explain.   There is a fpecies of worm
found in fheep that die of the rot, and, perhaps,
this is the caufe of the rot, as in marfhy grounds
the difeafe is more common.   We find within the
gall ducts a worm of a particular kind, which
feeds on bile.   From its mouth branches are dif-
perfed, like the branches of an artery, and are all
filled with bile; fo that the mouth of the animal
is its aorta, and the branches are propagated to
the moft diftant parts.

DCCLXXXIV.

When the liver is in a fchirrous ftate, it is
fometimes leffened in its bulk.   De Haen gives an
inftance of a fchirrous liver not bigger than the
fift, but, for the moft part, it is bigger; and in
the interftices of the veffels we find depofited a
febaceous-like matter, and knots fcattered un-
equally through it; and we can generally dif-
tinguifh the fchirrous by laying the hand on the
edge of the the thorax, and particularly about the

middle, as we can generally firſt feel it under the cartilago enſiformis. The ſize is ſometimes very great, deſcending half way to the umbilicus, and even half way between the umbilicus and os pubis, and yet without dropſy.

DCCLXXXV.

Should a ſuppuration happen in the liver, a conſequence of inflammation, we ought to attend to all the poſſible ways in which the pus can be diſcharged. In a ſound perſon the liver is covered in its under part by the peritonæum, upon which the bowels play freely, and it adheres to the containing parts by its ligaments; but the inflammation breeds adheſions in the neighbourhood: by the ſuppuration the liver is enlarged, deſcends under the edge of the thorax, and the abſceſs frequently adheres to the peritonæum lining the muſcles; ſo if an opening is made under the edge of the thorax, we get into the cavity of the abſceſs without opening the cavity of the abdomen; but if the abſceſs is within the edge of the thorax, it may make its way through the diaphragm; and as this is almoſt contiguous to the pleura, it being thickened and inflamed, may come to adhere to the ſide; and the matter eroding, this may make its way outwards, or into the lungs, if they come to adhere. Caſes of this kind have occurred, where bile has been thrown up by coughing, or it may come to adhere to the parts immediately beneath,

to the ſtomach, and to the great arch of the colon ; and we have many examples in practice, where abſceſſes of the liver were freely diſcharged by vomiting and ſtool ; or, the matter may get into the cavity of the alimentary canal, by the eroſion of the biliary ducts ; and where the matter is very deep in the liver, the matter may find its way into the gall bladder, which has been found diſtended with purulent matter : or, ſuppoſing the abſceſs to burſt into the cavity of the abdomen, the matter may fall down into the pelvis, and reſting on the rectum, may inflame and erode it, and ſo get out of the body.

DCCLXXXVI.

Morbid Changes of the Gall Bladder.
Inflammation.

The coats here, when inflamed, are connected with the inflammation of the membrane of the liver, which is ſpread over the gall bladder, and thus communicates its affections more or leſs to it. No peculiar appearances diſtinguiſh this inflammation from the ſame affection of the ſtomach and inteſtines.

Symptoms.

The ſymptoms are the ſame with thoſe which attend the membranous inflammation of the liver.

DCCLXXXVII.

Adheſion.

Diſſections ſhow frequent adheſions of the gall

bladder to the end of the flomach, or beginning of the duodenum, being the effect of previous inflammation. This admits no external fymptoms.

DCCLXXXVIII.

Ulceration.

Ulceration of the gall bladder, though met with, is a very rare occurrence, and begins in the inner membrane, while the other coats do not appear affected. Neither does it appear to be much an effect of gall ftones. We have no external information to detect this morbid change.

DCCLXXXIX.

Tubercles.

Tuberculous ftate of the liver is fometimes, though rare, communicated to the gall bladder, when its coats alfo are confiderably thickened; and, in the fame way, a folitary inftance or two has been obferved of the coats being converted into an offeous matter.

DCCXC.

Dilatation of the Ducts.

The three ducts are often found dilated to an amazing fize, near the extent of an inch in the tranfverfe diameter. This is the effect of the paffage of gall ftones, which often defcend, of a very great fize, into the duodenum.

DCCXCI.

Obliteration of the Ducts.

This appearance is very rare, but it has oc-

curred, and may be referred, wherever it take
place, to one or other of the following caufes :

1. Violent inflammation of the inner furface of
the ducts producing adhefion.

2. The fame ftate of the duodenum involving
the ductus communis choledochus.

3. Schirrus of the round head of the pancreas
acting by preffure on the fame duct.

Symptoms.

The chief fymptoms of this ftate will be per-
manent jaundice, which may equally arife from
a tuberculous ftate of the liver.

DCCXCII.

Paffage between the Gall Bladder and the Stomach.

A deviation from the common ftructure has
been met with in a communication, by a fhort
canal between the gall bladder and fmall extremity
of the ftomach.

DCCXCIII.

Gall Stones.

Stones in the gall bladder, or ducts, are a fre-
quent appearance on diffection ; and the bladder
is often largely diftended by them, with its coats
proportionally thickened.   The exiftence of a
fingle ftone is marked by its oval fhape, that of a
number by their many fides and angles.   In their
internal appearance, gall ftones differ in their
colour, in their internal texture, and in their pro-
perties.   With regard to the firft, their colour is

of confiderable variety, as white, black, and all the intermediate gradations between thefe two extremes. In their external appearance they differ, fome being fmooth in their furface, and others a good deal tuberculated. Their internal texture is made up of concentric laminæ, within which there appears a radiated ftructure. But the proportion of thefe to each other varies in different calculi, and alfo the loofenefs and compactnefs of the matter of which each is compofed. Chemical experiments fhew the conftituent principles, and confequently the properties of gall ftones are fomewhat different.

Symptoms.

The prefence of gall ftones is only detected when they attempt to pafs the ducts; and then, if large, they create moft excruciating pain about the pit of the ftomach, with languor, ficknefs, and vomiting, yellow fuffufion of the fkin, but the pulfe is little accelerated.

DCCXCIV.

Bile.

The moft common appearance of the bile is that of a brownifh yellow colour, with a certain vifcidity greater in man than in other animals. It is changed by difeafe at times into a ropy fluid like mucus; and it is even found deprived of colour like the white of an egg. A tuberculated liver, and enlarged mefenteric glands, attend this change. From the tranfuding of the bile through the biliary coats after death, the ftomach and

duodenum appear always on diffection tinged with this fecretion. Accumulation of bile producing diftenfion of the organ, and alfo a defect of it, attended with contraction of that vifcus, are morbid ftates occafionally met with. Hydatids alfo, in this fituation, are ftated as an occurrence, though rare. Even the gall bladder has been found wanting in cafes of malconformation.

DCCXCV.

Morbid Changes of the Spleen.

Inflammation of the Coats.

The coats of the fpleen are affected with inflammation, only from the affection of the peritonæum. In this ftate they exhibit an increafed vafcularity, a more thickened texture, and a depofition of coagulable lymph on their furface.

Symptoms.

The fymptoms of this affection are, pain of the left hypochondrium, more or lefs acute, increafed on preffure, with fymptomatic fever and difficult refpiration.

DCCXCVI.

Adhefions.

Adhefions of the fpleen to the neighbouring vifcera are often met with, formed by a firm white membrane, and thus it is found attached to the diaphragm, great end of the ftomach, and arch of the colon. Thefe adhefions are marked by no external fymptoms.

DCCXCVII.

Inflamed Subflance.

This affection is fo rare that it may be barely noticed.

Symptoms.

The marks of this ftate defcribed are, a fullnefs and fenfe of pain in the left hypochondrium, increafed on preffure, with general fever. The fenfe of pain has been alfo mentioned as diffufed over the abdomen.

DCCXCVIII.

Morbid Softnefs and Hardnefs.

The fpleen is found in two oppofite ftates, either of preternatural foftnefs or hardnefs. The former of thefe is to fuch a degree that, on breaking the capfule, its fubftance feems to confift of a brownifh red mucus, intermixed with fpongy fibrous texture. It is peculiar to middle and advanced life, but is diftinguifhed by no peculiar fymptoms. The latter, or its hardened ftate, is generally attended with an enlargement, fo as at times to exceed its proper fize by 5 or 6 times, when it can be eafily diftinguifhed by the external feel ; and it fhews alfo in this ftate a greater compactnefs of ftructure. Water in the abdomen often attends this affection.

Symptoms.

The fymptoms of this difeafe are only diftinguifhable externally, in its advanced ftage, by the

fituation and fhape of the tumor, its anterior edge being felt irregular under the margin of the ribs on the left fide. Afcites alfo is found prefent.

DCCXCIX.
Tubercles.

Scrofulous tubercles occafionally appear on the fpleen, fimilar to thofe on the lungs; but no peculiar fymptoms diftinguifh them.

DCCC.
Cartilaginous Coats.

This is a common difeafe of the fpleen, the covering of its convex furface fuffering more or lefs this change. It varies in thicknefs in different cafes, refembling, in appearance, the cartilage of the nofe, confifting of a fmall layer, but at times irregular. The procefs muft naturally be flow, and hence no peculiar fymptoms indicate the change.

DCCCI.
Enlargement.

Enlargement of the fpleen, without difeafe, is a frequent appearance, and requires therefore only to be noticed.

DCCCII.
Hydatids.

Hydatids affect the fpleen in the fame manner as the liver, though lefs frequently.

Symptoms.

The marks of this affection are, pain of the left

hypochondrium, with fwelling fpreading flowly into the cavity of the abdomen, having a foftnefs to the feel, and fenfe of obfcure fluctuation.

DCCCIII.

Concretions, &c.

Stony concretions have been noticed as an appearance obfervable in the fpleen at times. Its rupture, alfo, has occafionally occurred in confequence of external preffure, though this can only take place when it is much enlarged. A fpecies of peculiarity is alfo marked at times in the ftructure of this organ, being an appearance of feveral fmall fpleens, as well as the large one. Some of thefe equal in fize a walnut, are fituated in the omentum, and derive their circulation from the fplenic artery and vein. This organ has been likewife found wanting at times, and no difference has been experienced in the apparent ftate of health or exercife of the vital functions.

DCCCIV.

Morbid Changes of the Pancreas.

Thefe are fewer than in moft of the other organs, as diffections evince.

DCCCV.

'ce/s.

Abfcefs, however, here, has been met with, attended with an enlargement of the organ, and the difcharge of a confiderable quantity of pus.

Symptoms.

The fymptoms of this affection are, more a dif-
fufed pain of the abdomen than fixed in the feat
of the organ. Spafms of the inteftines and ab-
domen alfo attend, and ficknefs, and diarrhæa.
Pains of the back and loins have been alfo noticed.

DCCCVI.

Hardnefs.

A hardnefs of this organ, with its thickened
flate, and fhortened in fize, is a common appear-
ance, and feems the commencement of its fchirrus.
When actual fchirrus takes place, its ftructure is
enlarged and changed into a uniform white mafs,
interfected by membranes as elfewhere.

Symptoms.

This ftate, when advanced, has been marked
by continued pain in the epigaftric region, and
ficknefs at the ftomach, with a fenfe of hip pain,
and numbnefs of one leg and thigh.

DCCCVII.

Calculi.

Calculi, of a white colour, are formed in the
duct of this organ, and have been found equal in
fize to a hazel nut. They are eafily diffolved in
the muriatic acid, and therefore differ from uri-
nary calculi.

Symptoms.

The fymptoms of calculi here, can only be
thofe which commonly attend irritation; but they

poffefs no peculiar marks of difcrimination, fo as to afcertain the exiftence of the difeafe.

DCCCVIII.
Defect.

This organ has been found wanting in fome rare inftances.

DCCCIX.
DISEASED STATE OF THE KIDNEYS.
Inflamed Capfule.

The inflammation here is a rare occurrence, from its loofe connection with the peritonæum. When it happens, the fame appearances will be exhibited as in inflammation elfewhere.

Symptoms.

Inflammation of the kidneys is marked by pain felt in their fituation, fhooting along the courfe of the ureters, with a fenfe of numbnefs in the thigh, or retraction or pain in the tefticle. The fymptoms are only felt in the fide affected. The difcharge of urine varies in colour, being moftly of a deep red. Sicknefs and vomiting attend here, as alfo coftivenefs, and occafionally cholic, joined with fymptomatic fever.

DCCCX.
Abfcefs.

Inflammation of the kidneys terminates in fup-puration and abfcefs more frequently than that of any other gland in the body, and thefe abfceffes poffefs a fcrofulous difpofition, appearing in the

form of one or two circumscribed fores, full of
curdy matter.   The inner furface is alfo lined
occafionally with a pulpy matter.

The effect of such abfceffes is to deftroy, firft,
the mamillary portion, and afterwards, in the
progrefs, the whole ftructure of the kidney, fo
to change it into caplules furrounding a num'
of morbid cavities; a the' c..pfules are
quently thick, laminated, and of confiderable h
nefs   In its progrefs the affection generally ...
tends to the pelvis and ureter.

Symptoms.

The formation of abfcefs in the kidney
known by the mixture of n with the urine;
the quantity of pus will fu.. ..vna* determine the
ftate of the affection.

DCCCXI

Tubercles.

A tuberculous ftate of the kidney is ve   ..
Where it appears, it refemb' , in its ap   o
the tubercle of the lungs.

Symptoms.

No external fymptoms difcriminate this affe.   ..

DCCCXII.

Schirrus.

Schirrus of the kidney exhibits a plain, br   .,
uniform fubftance, interfected by membranes, v. h
an enlargement of the gland.   It is, however, a
rare appearance here; and where it occurs in.

the whole of the kidney it muſt be attended with
the very worſt ſp cies dropſy. If the diſeaſe
occurs from a ſchirrus the liver, it is formed of
the milder p h lood, and the water is
 lable hea wl en the matter paſſing
y the urine is excervaſated into the cavities of the
ody moſt readily yielding to it, and even in the
ventricles of the bra i which fr quently is the
c ſe, it muſt be att nded with the worſt con-
ſeqtences; and whe the cbſtuction s lower,
the effect is nearly th ſame as when t is in the
kidney itſelf.

The ſympt s nave never been jeſtly diſcri-
ted.

DCCCXIII.

? ..h n State.

Diabetic kid ys ſhew an increaſed vaſcularity
f ſtructure w h the ſuperficial veins, diſplay-
ing a fullneſs of their c nten s, and forming a
net-work. The appearance of he kidneys in this
diſeaſe i much like that of inflammation. A
quantity of whitiſh fluid, reſembling pus, is alſo
dere ted in the ſubſtance of the kidney.

Symptoms.

The ſymptoms of diabetes are, the increaſed
quantity of urine o a ſweetiſh taſte and watery
colour, great thirſt, and voracious appetite, with
an increaſe of pulſe, and gradual emaciation.

DCCCXIV.
Softnefs.

The kidney appears, at times, converted into a loofe mafs, like a fponge; and this fpongy ftructure is found, on diffection, to pervade every part of it. This is a peculiar procefs, by which part of its fubftance is abforbed, and the cortical part in this abforption fuffers moft.

Symptoms.

No general fymptoms can detect this peculiar ftate.

DCCCXV.
Hydatids.

Hydatids in the kidneys are not fo common as in the liver. One or two large ones, however, are fometimes confpicuous on its furface, fituated between its fubftance and capfule, and occafionally their number is even greater. They are of a pulpy nature, with thin coverings, the fame as any other membrane, and they are found here alfo only of one fize. But the true hepatic hydatid is alfo to be met with in the kidney, occafioning a change of the whole internal ftructure of the organ, and contained in a thick laminated bag, often of a cartilaginous hardnefs. Being of different fizes, from that of an orange to not more than the head of a pin, fome of them have been voided by urine, occafioning much exertion in the bladder to expel them, and producing, of courfe,

an increafed thicknefs of its mufcular coat, like
other caufes of obftruction.

Symptoms.

The only fymptoms here are, pain felt in the
loins during the formation of the difeafe, along
with fymptomatic fever, naufea, and vomiting;
but thefe attend alfo affections from another
caufe, fo that the paffage of the hydatids by the
urethra is the only certain criterion of their ex-
iftence.

DCCCXVI.

Calivli.

The kidneys are the moft frequent feat of cal-
culi, and they appear lodged either in its body, or
in the pelvis of the ureter; where, by their ftay,
increafing in fize by new depofitions, they affume
from the fhape of their fituation an arbofcent form.
In their colour, they are either white, or affume
different fhades of brown; and their furface, though
at times fmooth, is for the moft part roughened
and irregular. The obftruction they form to the
paffage of the urine, occafions an alteration in the
ftructure of the organ, the pelvis and cavity of the
kidney becoming very much enlarged; and the
ureter alfo fuffers a change in the fame manner,
according to the particular part of the organ at
which the calculus occafions an obftruction. So
enlarged does the kidney at laft become, as to lofe
entirely every appearance of its natural ftructure,

and to confift folely of a capfule containing a
number of cells; yet, even with this lofs of ftruc-
ture, the powers of fecretion in the organ ftill
remain entire as before, and the urine is feparated
in the fame quantity, and entirely of the fame
nature.

As a calculus occurring here is a frequent caufe
of inflammation in the kidney, perhaps an inflam-
mation here difpofes to the growth of calculi;·
feveral circumftances lead to that notion. Some
perfons are more fubjeɛt to calculous concretions
than others, and there is no doubt a conftitution
that difpofes to it; this is chiefly in the kidney;
and a morbid change may be made by inflamma-
tion, which gives that difpofition. It begins to
be formed long before the urine is extravafated.
Small particles of calculi are obferved within the
tubuli; and, as the inflammation is often evidently
brought on by calculi; fo, if fuch perfons get
cold, or are affeɛted by intemperance, there is an
uneafinefs of the kidney, and a difcharge of fand,
and here the pain of the kidney feems to be the
confequence of this want of attention.

Symptoms.

The fymptoms of calculi, and thofe of inflam-
mation, are much the fame, except that in the
former there is a depofition of red cryftals on the
difcharge of urine, an occafional mixture of blood,
and an increafed pain of the loins on motion.

DCCCXVII.

Offification.

The change of the kidneys into earth and offeous matter, has been stated by authors; but thefe are appearances that muft be extremely rare, and barely deferve notice.

DCCCXVIII.

The kidneys difplay much variety from original formation, both in their fituation and ftructure, being occafionally joined together, or before the lumbar vertebræ, or at the fides of the pelvis; and in fome inftances they are very fmall, or this is only on one fide, and the other is enlarged. Sometimes the kidney of one fide is wanting.

DCCCXIX.

Morbid Changes of the Renal Capfules.

Thefe are rarely affected by difeafe. An inftance or two of their abfcefs has been ftated, and alfo their fwelling from a fcrofulous caufe; for their enlargement, and their being filled with a white matter, fhewed fuch a difpofition. Their converfion into cartilage, and even the appearance of ftony particles in their fubftance, has been alfo detected.

DCCCXX.

Diseases of the Bladder.

Inflammation of the Peritonæal Coat.

Inflammation only takes place here when it is

general over the membrane, and it is ufually con-
fined to it, and does not extend to the other coats
of the bladder from its loofe connection to them,
and the interpofition of cellular matter.   A con-
fequence of this inflammation is adhefion of the
bladder to the neighbouring parts, in the male to
the rectum, and in the female to the womb.

Symptoms.

The fymptoms are chiefly pain and heat in the
region of the bladder, without much influence on
the functions of the organ.

DCCCXXI.

Inflammation of the Bladder.·

The inflammation of the inner membrane is
more or lefs extenfive, from its fpreading over
the whole organ to its affecting merely a parti-
cular part; and, when partial, the vicinity of the
neck is generally the feat of it.   The appearance
of this inflammation confifts in an increafed vaf-
cularity, and frequently extravafation of blood.
The mufcular coat, however, is commonly not af-
fected.

Symptoms.

This affection is attended with pain and fullnefs
in the peritonæum, or above the pubes, with fre-
quent fmall and painful micturitions, or a total reten-
tion of the difcharge, attended with urgent defire.
Tenefmus of the rectum alfo takes place, and the
ftomach fympathizes, being affected with ficknefs

and vomiting. Not unfrequently delirium pre-
vails. The formation of pus is marked by its ap-
pearance in the urine difcharged.

DCCCXXII.
Ulceration.

This is often a confequence of the former affec-
tion terminating in fuppuration ; and when ulcers
are of the common kind, no peculiar circumftances
mark their appearance here. In their effects, a
portion of the bladder is often deftroyed, and
communications are thus formed between it and
the neighbouring parts, either with the abdominal
cavity, or the rectum in the male, or vagina in
the female. The confequence of the firft is general
peritonæal inflammation; of the two laft, much
irritation and pain, and the difeafe often conti-
nuing for life.

Local violence is generally the caufe of abfcefs
here, and particularly the operation of lithotomy.
In fome cafes, the inner membranes of the bladder
has been entirely feparated by the procefs of appa-
rently fcrofulous ulceration.

Symptoms.

The fymptoms of ulceration here are maiked
by pain and difficulty in making water ; and where
communications are opened by ulceration, the
paffage of the urine detects thefe; and the pain
and irritation, from affecting the parts it pervades.

DCCCXXIII.
Schirrus and Cancer.

These diseases are only communicated here from neighbouring parts, and are seldom original, being extended either from the rectum or uterus. In this situation they are characterised by the same thickness and hardness as when affecting other parts, and communications necessarily prevail with these parts.

DCCCXXIV.
Fungus.

Fungus appears on the inner surface of the bladder, either in one mass, or detached pieces, which seem composed of a loose fibrous texture. If situated behind the neck, obstruction of the urine is the consequence; and a stronger action required to expel it, occasions a thickening of the muscular coat.

Symptoms.

The difficult discharge of urine is the only symptom of fungus; and if it is situated near the neck, it may perhaps be ascertained by the introduction of the sound, which touching it, will give the feeling of a soft tumor; and an examination of the rectum will mark its distinction from a diseased prostate.

DCCCXXV.
Polypus.

Polypus of the bladder has been observed, con-

fifting in various irregular projecting maffes of a
firm texture; but this appearance is very rare,
and the fymptoms are the fame with thofe of the
fungus.

DCCCXXVI.

Elongation of the inner membrane forming irre-
gular proceffes in certain parts, confifting of much
cellular membrane intermixed with fat, is an ap-
pearance obfervable in the bladder at times.

Symptems.

This difeafe muft be flow in its progrefs;
neither will any inconvenience attend it, unlefs
it preffes on the neck, when a difficulty of water
will enfue.

DCCCXXVII.

Cyfts.

Cyfts of various fizes are found intimately con-
nected with the bladder, and opening into its
cavity.   They are mobably pouches formed from
the bladder itfelf, though they are often found of
a prodigious fize.

DCCCXXVIII.

Thicknefs of the Mufcular Coat.

This is the common confequence of all difeafes
where the action of the bladder is much increafed.
From ¹ inch, its natural thicknefs, it is increafed at
times to half an inch; ftill retaining, however, its
pale colour, without any additional rednefs, and
having between the fafciculi, or its inner fibres,

little pouches from the inner membrane.   Thefe
pouches equal at times, in fize, the extremity of
the little finger, and fmall calculi are contained in
them.   This is more a difeafe of the male than of
the female.

Symptoms.

The fymptoms of this difeafe are, frequent in-
clination to void urine, from the fmall capacity of
the bladder to contain it.

DCCCXXIX.
Divifion of the Cavity.

The bladder has been obferved divided into two
chambers, an upper and a lower one, feparated by
firm membranous fubftance, and having an aper-
ture of communication.

Symptoms.

The fymptoms of this difeafe in its advanced
ftate are, a confiderable circumfcribed tumor above
the pubes in the fituation of the diftended bladder,
a leffened difcharge of urine, and no way affecting
the fize of the tumor when difcharged.   At times,
a large emiffion of urine, from the choice of fome
particular attitude, enabling it to defcend into the
lower chamber, and the tumor of the pubes fub-
fiding in confequence of this, with a releafe of
fymptoms till a new accumulation.

DCCCXXX.
Calculi.

Calculi are a frequent difeafe in the bladder,

affecting the male oftener than the female, and conspicuous at every period of life. The origin of this affection is either from the kidneys descending by the ureters, or it is found in the bladder itself. An extraneous substance, forming a nucleus, is sometimes the cause of these calculi, either loose, or confined to a particular part of the organ. In the latter case, they are sometimes lodged in cysts formed by the inner membrane, or attached to an excrescence of the bladder, retaining it in that situation. Where one calculus only exists, it is commonly of an oval form; where more, they acquire by friction flat sides and angles. In general, the surface of calculi is granulated, from which they acquire a certain degree of roughness, and this roughness varies in different cases, according to the size of the granules; occasionally, instead of this, the surface appears of a porous structure. The division of calculi exhibits a laminated texture in concentric curves compactly applied, and varying in the thickness of the laminæ. At times, also, a porous structure is conspicuous. The colour of calculi is very various, but brown chiefly prevails, of different degrees; and the colour of the same calculus varies in different places, the outside being of one colour, and the inside of another. Both the specific gravity of different calculi, as well as their chemical qualities, differ widely from each other;

and though the matter of calculus is thus found
in the bladder, for the moft part formed into one
or   ircun   bed maffes, there are inftances
whe   'e whole of its cavity is filled with a fub-
ftance like mortar.

Symptoms.

The fymptoms of calculus are well afcertained,
and confift of an uneafinefs at the orifice of the
urethra after the difcharge of urine, or any exer-
tion, with more or lefs of a dull pain at the neck
of the bladder. Frequent micturition alfo takes
place, paffing either in drops, or with the ftream
fuddenly fufpended. The urine difplays a large
depofition of mucus, and is alfo occafionally tinged
with blood. Tenefmus is likewife a common
fymptom.

DCCCXXXI.

Diftenfion and Contraction.

Diftenfion of the bladder occupying the lower
part of the abdomen, is a very common appear-
ance on diffection; and, in an oppofite extreme,
it is alfo difcovered at times fo contracted, as
hardly to difplay any cavity arifing from its ftrong
action before death.

DCCCXXXII.

Defect of the Anterior Part.

A want of this part occafionally appears; the
place of which is fupplied by a foft, vafcular,
texture, externally fituated on the abdomen,

and formed of projecting maſſes, having on them a layer of thick ropy mucus. On this maſs the ureters open, and it is attended with malconformation in the parts of generation.

DCCCXXXIII.

Communication with the Rectum.

A connection of the rectum with the dependent part of the bladder is ſometimes met with, being the effect of original malconformation; and another, though a rare appearance, is the bladder being found lodged in a hernial ſac, both at the abdominal ring and under Poupart's ligament.

DCCCXXXIV.

Morbid Changes of the Male Genital Parts.

Inflammation of the Veſiculæ Seminales.

The veſiculæ feminales are occaſionally the ſubject of diſeaſe, though it is difficult to detect it. Their inflammation is generally derived from that of the contiguous parts; and, in conſequence of this, adheſions have been formed by them; and likewiſe ſuppuration has taken place in their ſubſtance.

Symptoms.

No peculiar ſymptoms can mark inflammation here diſtinct from that of the other contiguous parts.

DCCCXXXV.

Scrofulous Accumulation.

The appearance of a ſcrofulous matter has alſo been traced in the veſiculæ feminales.

DCCCXXXVI.

Malconformation, &c.

The ducts of the veficulæ feminales are occafionally wanting, or do not open into the cavity of the proftate gland. By the femen being thus prevented from paffing into the urethra, fterility muft be the natural confequence. A morbid fmallnefs of their ftructure has been alfo detected, rendering them unfit for the execution of their functions, though one is often found fmaller than the other. Even one of them has appeared wanting, in which cafe the vas deferens of that fide being enlarged and tortuous, has probably fupplied its place. Schirrus and calculi of thefe parts have been alfo noticed.

Symptoms.

None of thefe affections have been diftinguifhed by any leading fymptoms in the living body, and diffection only has made known their exiftence.

DCCCXXXVII.

DISEASES OF THE PROSTATE GLAND.

Abfcefs.

The appearance of abfcefs in the proftate gland fhews its being fubject to the common attack and progrefs of inflammation, and this abfcefs poffeffes nothing peculiar more than abfcefs of other parts.

Symptoms.

The marks of inflammation here will be pains or lefs acute at the neck of the bladder,

with difficulty in making water, and some tenes-
mus; and the quick progress and acuteness of pain
will distinguish it from schirrus.

DCCCXXXVIII.
Scrofula.

The prostate, on dissection, often discloses the
same curdy matter as in other scrofulous glands,
and pus has been pressed from it in this state.

DCCCXXXIX.
Schirrus.

Schirrus, however, is the most common affec-
tion of the prostate gland; and the consequence
of this is, its enlargement to equal the size of the
fist, displaying on dissection the marks of schirrus
elsewhere, or a firm white or brown substance,
intersected by membranous septa in various direc-
tions. In this state, its posterior extremity pro-
jects deep into the cavity of the bladder, by which
the urinary discharge is interrupted from entering
the urethra, and that in a greater or less degree,
according to the extent of this projection. Where
this is very great, an instrument cannot be passed,
and an artificial passage is sometimes made by the
side of the gland. In this way life is often pro-
tracted under this disease. The gland, also, often
assumes an irregular growth, and a winding pas-
sage is formed through it by the change in the
shape of its cavity, which increases the difficulty
of making water. Not unfrequently with its en-

largement its furface becomes ulcerated, and a fiftula occafionally appears between it and the rectum.   From a difeafed proftate gland the blad-der naturally fuffers; and being excited conftantly to extraordinary exertions, its fubftance becomes thickened and ftronger.   This affection is a difeafe of advanced life.

Symptoms.

The marks of a difeafed proftate gland are, dif-ficult micturition, and in fmall quantity, fometimes a total fuppreffion of it.   The fame uneafinefs at-tends the paffage of the faeces, and a continuance of the defire after it is over.   Mucus from the urethra frequently follows thefe evacuations, from the exertion employed.   The introduction of a bougie or catheter detects the difeafe by the place of its ftoppage.

DCCCXL.
Calculi.

Small brown calculi of the fize of a pea are occafionally found in the ducts of the proftate, and confift chiefly of phofphate of lime.

Symptoms.

The only fymptoms here will be difficulty of urine, and the feeling to a found, or catheter, of a ftone impacted in the neck of the bladder.

DCCCXLI.
Enlarged Ducts.

he enlargement of the gland, and widenefs of

its ducts, so as to equal the size of a small quill, sometimes appears. This state is always the effect of stricture in the urethra, which obstructing the passage of the urine, occasions its accumulation behind, and its dilatation of these parts; while the bladder itself suffers from the same cause, and a thickening of it also attends this affection.

DCCCXLII.

Preternatural Smallness.

The prostate gland has been found in an opposite extreme preternaturally small, so as to be unfit for performing its functions. But this malconformation was extended to other parts of the genital system.

DCCCXLIII.

MORBID CHANGES OF THE URETHRA.

Abscess.

The membranous part of this passage is the seat of abscess, and it may arise from external or internal causes; but obstruction of the urethra from stricture is the most frequent source of this malady. By the irritation of the urine behind the stricture, inflammation and its consequences are induced, and an abscess breaking externally, the urine is discharged through the aperture.

Symptoms.

Stricture of the urethra is marked by more or less difficulty in the discharge of urine, which is in a small forked stream, scattered as it were; and

often it paſſes in drops.   Some gleety appearance
likewiſe attends.   Various ſymptoms ariſe in the
contiguous parts from ſympathy, and conſtitutional
irritation is frequently connected with the local
affection.

DCCCXLIV.

Fiſtula.

The continuance of the former affection, with
no diſpoſition to heal, conſtitutes fiſtula here; or
the parts acquire a thickened hardneſs, and the lips
of the orifice turn callous.   The moſt common
ſeat of this diſeaſe is behind the ſcrotum, or near
the membranous diviſion of the urethra; and
theſe fiſtulæ frequently diſplay ſeveral openings
into ſhort canals, which run in various directions.

Symptoms.

This affection is conſpicuous by the external
ſymptoms.

DCCCXLV.

Calculi.

By the compaction of calculi, the membranous
part of the urethra is formed into a bag, often ſo
large as to contain a ſmall egg; and, by the con-
tact of the urine, the calculus in this ſituation
gradually increaſes, as elſewhere.   The marks of
this ſtate are evident on external examination.

DCCCXLVI.

Cowper's Glands.

Cowper's glands have been mentioned as changed

into ligament; but diffections feldom fhew them
the fubjects of difeafe.

DCCCXLVII.

Inflamed Membrane.

The inflammation of the inner urethral mem-
brane is fimilar to that of other fecretory mem-
branes. It difplays in this ftate an increafed
vafcularity, and an augmented fecretion of its
glands. The feat of this inflammation is gene-
rally at its anterior extremity, but the inflammation
fpreads through its whole furface; nor is it con-
fined to the membrane alone, but fpreads into the
fubftance of the fpongy parts, affecting its whole
ftructure. The confequence of its thus extend-
ing is increafed thicknefs and hardnefs of thefe
parts, and the depofition of coagulable lymph into
the cells, which thus acquire a more vafcular
ftate. Even the glands become augmented, and
feel like round tubercles to the finger.

Symptoms.

External fymptoms mark fufficiently this ftate
of difeafe.

DCCCXLVIII.

*Ulcers.**

This is a very rare appearance in the urethra,
as the inflammation here feldom extends that
length.

Symptoms.

Much pain at a particalar part, and a difcharge

from it mixed with blood, will give fome evidence
of this ftate.

DCCCXLIX.
Stricture.

.Stricture was formerly noticed as the moft fre-
quent affection of this part, by which the canal is
partially narrowed, or altogether obliterated. Its
moft common feat is a little anterior to the mem-
branous divifion of the urethra; and here it ex-
hibits various appearances, as confiling either in
a fimple approximation of the oppofite fides of the
paffage, or in its contraction for a certain extent,
either attended with the apparent natural ftate of
its furface, or its thickening and hardnefs, with a
partial abrafion or ulceration.

Thefe confequences are often augmented by
mechanical attempts at relief, the ulcerations
being extended, and not unfrequently even a new
paffage formed. The stricture alfo prevails in
different places, and is at the fame time irregularly
placed on one fide, fo as to give obliquity to the
paffage.

Symptoms.

The fymptoms of this affection were already
detailed as a caufe of inflammation.

DCCCL.
Caruncle.

An excrefcence from the urethra is a rare oc-
currence. In fcrofulous conftitutions, however,

it is occafionally obfervable on diffection, and therefore falls to be noticed.

Symptoms.

The fymptoms of this affection cannot differ from thofe of ftricture.

DCCCLI.
Earthy Matter.

The depofition of an earthy matter in the bladder, formerly noticed, may be even extended here; and, accordingly, a thin layer of this fubftance has been found to pervade the whole canal.

DCCCLII.
Malconformation of the Orifice.

The external opening of the urethra is fometimes found to be placed under the frænum, or where it fhould be, for in fuch cafes no frænum exifts. The opening here is alfo fmaller than the natural one. Some other fpecies of malconformation are at times met with, but they are very rare.

DCCCLIII.
DISEASED TESTICLES.
Hydrocele.

A collection of water in the vaginal coat of the tefticle occurs at every period of life; but after manhood, it feldom fuffers a fpontaneous termination. A pyramidal bag, more or lefs thickened and laminated, approaching the ring of the abdominal mufcle, and extending at times to the ring

itfelf, is its common appearance. By this accu-
mulation the tefticle fuffers compreffion. The
fluid contained poffeffes the properties of the fe-
rum, and from undergoing a morbid change, ac-
quires a yellowifh, greenifh, or brown colour.

Symptoms.

The fymptoms of this affection are determined
by the pyramidal fhape of the fwelling, by its
want of pain, by its refiftance on preffure, by its
having no influence on the general health, and by
its tranfparency to the eye, when it is oppofed
to the light of a candle placed on the other fide
of it, or at leaft by its compreffibility, where the
thickening of the coat prevents this tranfparency
being fo diftinct.

DCCCLIV.
Hydatids.

This appearance has occafionally been found
within the vaginal coat, both loofe, and in a ftate
of adhefion; but the affection is rare.

Symptoms.

The marks of this affection will be the fame as
hydrocele, but its peculiar nature can only be dif-
tinctly known by opening the fwelling.

DCCCLV.
Cartilages.

The vaginal coat is alfo at times the feat of
cartilaginous fubftances, loofely placed in the
cavity, and of the fame nature as thofe appearing

occafionally in the joints, from a deranged fecre-
tion of the veffels.

Symptoms.

As they are productive of no great inconve-
nience, no peculiar fymptoms mark their prefence.

DCCCLVI.

Adhefion.

The vaginal coat becomes clofely attached to
the tefticle by a firm adhefion, either through its
whole extent, or only in detached points, varying
in their thicknefs of texture. They are always the
confequence of previous inflammation of the part.

DCCCLVII.

Inflammation of the Tefticle.

This gland is often fubject to inflammation,
which varies no way in appearance from that of
other parts.   The inflammation generally extends
to the vas deferens and the fpermatic cord, which
occafions a thickening of the coats of the former,
and the veins of the latter fometimes acquire a
varicofe ftate.   The inflammation is often fuc-
ceeded by a permanent hardnefs and fwelling of
the epididymis, arifing from extravafation during
the height of inflammation.

Symptoms.

Inflammation here is diftinguifhed by the uni-
form fmooth fwelling, by the rapidity of the in-
flammation, and by the inflammatory blufh or
rofy colour of the teguments.

DCCCLVIII.

Abfcefs.

Abfcefs here is a confequence of inflammation, though not fo frequent as in other parts; but it poffeffes here no peculiarities.

DCCCLIX.

Scrofula.

Scrofula here changes the tefticle into an enlarged mafs, which, when cut into, difplays a white or yellowifh curdy fubftance, mixed with pus in a greater or lefs degree.

Symptoms.

The chief marks of this difeafe are, a foftnefs of texture, a flight pain in the part, and a general healthy ftate of the fyftem.

DCCCLX.

Pulpy State.

The natural ftructure of the tefticle often degenerates into an entire brown, uniform, pulpy matter. This is a peculiar difeafe, equally diftinct from fcrofula and fchirrus.

Symptoms.

The fymptoms are the fame as thofe which mark fcrofula.

DCCCLXI.

Schirrus and Cancer.

A brownifh hard mafs, interfected in various degrees by membranes, characterizes fchirrus of this gland, where the natural ftructure is loft in

cells containing a fanious fluid, with an occafion-
al mixture of cartilages. In the progrefs of the
difeafe, the appendages of the tefticle, or the epi-
didymis and the fpermatic cord, take on the fame
morbid difpofirion. The ulceration of this mafs,
and its producing a fungous growth, conftitutes
cancer.

Symptoms.

The chief marks of this difeafe are, its great
hardnefs, and darting pain extending along the
cord, joined to its flow progrefs and particular
influence on the general health. In the ulcerated
ftate the fymptems are obvious.

DCCCLXII.
Cartilage and Bone.

In fome fchirrous cafes a predominance of car-
tilaginous fubftance prevails, marked by ulceration
in its centre ; and this cartilage differs in nothing
from common cartilage. A partial appearance of
offeous matter in the tefticle has alfo, at times,
been met with.

DCCCLXIII.
Malconformation of the Epididymis.

The termination of the epididymis in the vas
deferens has been wanting at times. By this
defect, the femen not being expelled into the
urethra, fterility muft be the confequence. Stric-
ture of the vas deferens alfo occurring from dif-
eafe, muft be attended with the fame effect in
regard to one tefticle.

DCCCLXIV.
Smallnefs and Wafting.

Smallnefs in the tefticle, which fometimes takes place in an extreme degree, is always attended with a want of venereal inclination. Wafting of the tefticle alfo occurs as an effect of difeafe, either of inflammation or compreffion. This wafting has been known in both tefticles. When occurring only in one, the natural powers continue as before. When one tefticle does not defcend at birth, but is continued in the abdomen, which fometimes happens, it remains of an imperfect fize in that fituation.

DCCCLXV.
Morbid Changes of the Spermatic Chord.

The fpermatic chord is liable to four different affections: fchirrus, fcrofula, varix, and dropfy.

The firft of thefe is generally conjoined with that of the tefticle, by the affection of which it is changed into a hard mafs of the fame nature with the tefticle itfelf, and at laft its effects extend to the lumbar glands.

The fecond is derived from the fame fource as the fcrofulous ftate of the tefticle, and exhibits the fame appearance in the change of its ftructure.

The third, or varix, is very common to this fituation, and it takes place in the veins of the chord in various degrees, from fimple enlargement to the moft diftended varicofe ftate. The chord

then becomes a bulky mafs, diminifhed on preffure, and very foft to the feel. From this increafe of the parts above, a wafting of the tefticle often enfues.

The fourth, or water, is found in this fitua-tion in two different places, either diffufed in the cellular membrane of the chord forming a local anaforca, and readily diminifhed on preffure, though accumulated here to the quantity of fome pints; or, what is more common, the water here is encyfted and lodged in a fac of the fpermatic chord, formed by a firm white membrane full of ferous fluid.

Symptoms.

In the encyfted kind, the tefticle is found under the fwelling diftinct and feparate, in which it differs from hydrocele.

DCCCLXVI.

MORBID CHANGES OF THE FEMALE GENITAL SYSTEM.

Uterine Affections.

Inflammation.

The inflammation of the uterus is generally a confequence of parturition, when occurring; and its affection is extended, more or lefs, over the peritonæum. Its appearances are the fame with thofe of inflammation elfewhere, and its fundus and body are the chief feat of this morbid ftate. In its progrefs, it extends along the uterine ap-pendages, and not unfrequently uterine inflam-

mation terminates in abfcefs, with pus collected
in the large uterine veins. The peritonæal affec-
tion, conjoined with this, appears the fame as
under other morbid circumflances, only there is
here a proportionally greater extravafation of co-
agulable lymph.

Symptoms.

The marks of inflammation here are, hypogaf-
tric pain and tenfion, increafed on preffure or-ex-
amination of the uterine orifice. The flomach
fympathizing, vomiting enfues, attended with an
irregular ftate of the bowels, general fever, and
much frequency of pulfe. On the peritonæal
affection being confiderable, added to thefe fymp-
toms, fwelling of the abdominal cavity takes place,
with increafed pain and tendernefs.

DCCCLXVII.

Ulceration.

The feat of this morbid change is the neck of
the uterus, from which it fpreads to the fundus,
fo as to deftroy the greater part of the organ,
and convert it into a tattered mafs. From the
uterus, it frequently fpreads alfo to the contiguous
parts, particularly to the vagina, bladder, and
rectum, with all which it forms communications.
In its firft ftage, the uterus becomes by it fome-
what harder, and enlarged. The chief period of
its attack is middle and advanced life, though it
is occafionally met with in young fubjects.

Symptoms.

Pain, more or lefs exquifite, in the part, with a purulent or bloody difcharge, forms the leading fymptom of the difeafe. Its progrefs, where communications take place with neighbour-ing parts, particularly the bladder, is marked by the difcharge of urine from that fituation. A fmall frequent pulfe, fallow look, and great emaciation, attend the advance of this malady, and fwelling of the inguinal glands from abforption.

DCCCLXVIII.

Schirrus.

A general fchirrous enlargement and hardnefs of the uterus, to equal in fize geftation at fix months, often occurs, fhewing on diffection a hard fubftance of a brownifh or brownifh white colour, interfected by membranes. An ulceration and tuberculous ftate of its inner furface is a frequent effect of its progrefs, and thefe tubercles contained in its fubftance are fimilar in ftructure to the uterus itfelf.

Symptoms.

This difeafe is only known in its advanced ftage by   more or lefs acute in the hypogaftric region; and by an examination of the ftate of the uterus, by the vagina feeling at the orifice hard and enlarged, with a confiderable weight of the organ when raifed on the finger. Not unfrequently the enlargement may be felt by application of the

hand above the pubes. A difcharge will be joined
with thefe fymptoms when it has paffed into ulce-
ration.

DCCCLXIX.
Tubercles.

An external tuberculous ftate of the uterus, as
well as an internal, the effect of fchirrus, is at
times difcovered. Thefe tubercles vary much in
fize, being irregular in fhape, and knotted. When
cut into, they fhew the fame general appear-
ance as fchirrus. One peculiarity is their fmall
tendency to ulceration. Inftead of numerous
tubercles, the uterine cavity is often filled by one
large mafs of this kind, which exhibits, on dif-
fection, the fame ftructure, and which is con-
nected to the uterus only by loofe cellular mem-
brane, while, except in its enlargement accom-
modated to the fize of this mafs, the organ is not
otherwife affected by difeafe.

Symptoms.

No fymptoms mark this affection in its early
ftate, and, in its advanced progrefs, it is no way
to be diftinguifhed from fchirrus.

DCCCLXX.
Polypus.

This is the fame difeafe as the tubercle, only it
differs in the manner of its connection with the
organ, adhering always to it by a fmall neck.
Thefe polypi vary in fize, from a walnut to the

magnitude of a child's head. The fundus is the most common feat of attachment, and more than one are generally found at a time in the uterus. Sometimes they differ from the tubercle, and confift of a mere loose bloody mafs, with tattered proceffes from it. This mafs, when opened, is formed either of a fpongy laminated fubftance, divided by interftitial cavities, or of the fame texture with larger ones. By thefe polypi the fize of the organ is augmented in proportion to their bulk.

Symptoms.

Pains of the loins, with mucous and occafional bloody difcharges, are the leading fymptoms here, till it is diftinguifhable by examination. The general health is little affected.

DCCCLXXI.

Inverfion.

Inverfion is the effect of a polypus, or the extraction of the placenta. In the firft cafe it is partial when there is an appearance of fiffure on the outfide, and the uterine appendiges are drawn inwards at both edges of the fiffure. In the fecond cafe, the inverfion is complete, and the inner furface expands, while the fundus forms a large tumor within the vagina, and even extends without the os externum.

Symptoms.

The fymptoms of incomplete inverfion can only

be gueſſed at from the exceſs of the diſcharge.
When complete, examination will aſcertain it.

DCCCLXXII.
Prolapſus.

A diſplaced uterus, by the yielding of the liga-
ments, occurs in thoſe who have a large pelvis,
or where the ſoft parts are much relaxed by labor.
By this means it falls down, ſo as to occupy the
external parts, or appears without them.

Symptoms.

This affection is obvious on examination.

DCCCLXXIII.
Stricture, &c.

Stricture occurs at that part of the uterus where
the fundus ends in the cervix. The parts become
here glued by ſome ſlight inflammation, or gradu-
ally approach each other ſo as to ſhut up the
aperture. In the ſame way, the os uteri has been
found cloſed up by the growth of a membrane,
and its opening obliterated. A bony ſtate of the
uterus has been alſo known, from a morbid ſecre-
tion of its veſſels. It has likewiſe been changed
into an earthy ſubſtance. Bone has alſo been
found in its cavity, ariſing probably from a tubercle
aſſuming this ſtate; and ſtones have not unfre-
quently occupied the ſame ſituation, varying in
their colour, and correſponding to concretions in
other glandular parts of the body. Even a dead
fœtus has been changed into an earthy matter by

remaining a long time in this cavity, ſtill preſerving its original ſhape.

DCCCLXXIV.
Water.

Dropſy of the uterus is a diſeaſe in which a large accumulation has at times taken place, even to the extent of 100 pints, the fluid poſſeſſing a bloody or yellowiſh appearance, and being ſerous as in other caſes. A ſtricture of the cervix always attends this morbid ſtate.

Symptoms.

The evacuation of water only aſcertains the certainty of this ſtate.

DCCCLXXV.
Hydatids.

Hydatids of the uterus differ from thoſe in other ſituations. They conſiſt of veſicles of a round oval ſhape, having each a narrow ſtalk by which they adhere to each other. They differ much in ſize, from a walnut to a pin's head, and the larger poſſeſs ſmaller ones adhering to them by narrow proceſſes. It is probable they are connected with impregnation.

Symptoms.

No marks can diſcriminate this morbid ſtate till the expulſion of the hydatids, when it is attended with pains reſembling thoſe of labor.

DCCCLXXVI.
Rupture.

Rupture of the uterus is an accident occasionally taking place at the end of pregnancy, or in the course of labor. The side of the uterus is generally the seat of it; and where the peritonæum remains entire, there is accumulated between it and the rupture much black coagulated blood, having much the appearance as if gangrene had taken place.

Symptoms.

The symptoms of this accident, though it is only certainly known by examination, are, pain, with a feeling in the belly of something giving way, chocolate coloured vomiting, suspension of labor pains, and a retraction of the presenting part.

DCCCLXXVII.
Varieties.

The size and thickness of the uterus varies in different cases, and also its situation being placed more or less laterally in the pelvis. A double uterus has also occurred as an instance of malconformation.

DCCCLXXVIII.
MORBID CHANGES OF THE UTERINE APPENDAGES ON THE OVARIA.
Inflammation of the Coats.

Inflammation of the peritonæal covering of the

ovaria arfes from its connection with other parts, and is never original. When affuming this ftate, it difplays the fame appearance as inflammation elfewhere; and the confequence of this is the adhefion of the ovaria to the neighbouring parts.

DCCCLXXIX.
Inflamed Subſtance.

This only arifes from inflammation of the uterus, and by this inflammation the ovaria become enlarged, hard, and vafcular. Frequently pus is formed in them.

Symptoms.

The fame fymptoms attend this affection as that of the uterus.

DCCCLXXX.
Schirrus.

Schirrus is a lefs frequent affection of the ovaria than of the uterus. By its attack they are changed into an enlarged, hard, white mafs, interfected, as in other parts, by membrane; and not unfrequently the change into hardnefs proceeds the length of bone, with a greater proportion of earth in it than common bone.

Symptoms.

Schirrus here can never be determined but in a very advanced progrefs of the difeafe.

DCCCLXXXI.
Softnefs.

The ovaria becomes at times enlarged and

changed into a brown pulp, with cells containing a fluid. Much the same appearance takes place when they affume a fcrofulous ftate.

DCCCLXXXII.

Dropfy.

The chief difeafe of the ovaria is dropfy, the whole fubftance being deftroyed, and changed into a bag containing a fluid. The fize of this is often large, firm, and white in its texture, while its fluid is capable of being in part coagulated. In this bag a number of cells are often alfo found, which communicate with each other, and at other times cyfts are found that have no communication. The fize of thefe cyfts is various, from a hazel nut to an orange; and their coats vary in their degree of thicknefs, and in the number and compactnefs of their laminæ. The fluid they contain is of various confiftence, from ferum to jelly; and it is not the fame in every cyft. Thefe cyfts adhere by broad furfaces to each other, and are only the natural ftructure of the ovaria enlarged.

Symptoms.

Dropfy of the ovarium, when advanced, is marked by an abdominal tumor on one fide, with an unequal furface and obfcure fluctuation, the general health little affected, and the urine no ways diminifhed.

DCCCLXXXIII.

Extraneous Productions.

The converfion of the ovaria into a fatty fub-ftance, having teeth and hair in it, is a fingular change that at times occurs. They are inclofed by a capfule of a white ftrong membrane. The hairs lie loofe in the fat, or adhere to the capfule. The teeth here want fangs; they are connected to the inner membrane of the capfule, or an irregular bony mafs. The origin of thefe productions are as yet inexplicable, though they do not appear connected with impregnation.

DCCCLXXXIV.

Fœtus.

An ovarial fœtus is a frequent appearance. It never arrives at any great fize. The ftructure of the ovarium becomes changed into a bag of fome firmnefs; and on the infide of the bag is attached the placenta, and part of the chorion. On this bag the Fallopian tube and fpermatics can be traced. The uterus affumes the impregnated ftate by an enlargement at the fame time, and formation of decidua. Its veffels are alfo augmented.

DCCCLXXXV.

Shrinking.

Age diminifhes the ovaria to half their fize, and renders them hard and tuberculated. Their veficles, in this ftate, are found filled with a white folid matter.

DCCCLXXXVI.
Defect.

The ovaria have been found wanting at times on both fides, and occafionally on one.

DCCCLXXXVII.
On the Fallopian Tubes.

The changes which the Fallopian tubes undergo, are fimilar to thofe of the ovarium. Thus inflammation is communicated to them from the uterus, and even their fuppuration takes place. Adhefions are formed by them, in confequence of inflammation, to the neighbouring parts, and particularly the fimbriated extremity of the tube is found adhering to the ovarium, or its ftructure and aperture are entirely loft. Dropfy alfo, from the adhefion of its two extremities, enfues. The aperture of the tubes is likewife at times wanting from malconformation, and an ovium has even been detained here in its defcent, and increafed in the tube to a confiderable fize, while the uterus is augmented, and receives all the other changes that take place, as if it had been depofited there. The tube is even fubject to affume the tuberculous ftate, and to poffefs a growth of a firm white fubftance, interfected by fepta the fame as the uterus.

DCCCLXXXVIII.
On Round Ligaments.

Thefe parts are expofed to the progrefs of in-

flammation from the uterus, and other affections which have been particularly noticed.

DCCCLXXXIX.
DISEASES OF THE VAGINA.
Inflammation.

Inflammation of the internal furface, near the os externum, is common from a venereal caufe.

Symptoms.

The fymptoms are fuch as conftitute gonorrhœa.

DCCCXC.
Adhefion.

The effect of violent inflammation is, adhefion of the fides, more or lefs general ; but it is moftly partial, and conftitutes ftricture.

Symptoms.

The marks of this are known by examination, and they may be previoufly fufpected by the abfence of the menfes, and the inability of fexual intercourfe.

DCCCXCI.
Ulceration.

Ulceration is here in various degrees, from a fingle fpot on the internal furface to a foul ragged fore. Thefe ulcers frequently arife from the uterus, and in their progrefs communications are formed by them with the neighbouring parts, particularly the bladder and rectum, which embitter exiftence.

Symptoms.

Examination is the furest means of their detection, and they are attended with more or less pain, and a purulent discharge.

DCCCXCII.

Schirrus.

Schirrus occurs here also without the fame state of the uterus, and nothing peculiar distinguishes its appearance here from what has been described elsewhere.

Symptoms.

The chief symptoms of it are, the glassy, painful, hardened feel, which the affected part assumes.

DCCCXCIII.

Inverfion.

Inverfion or prolapfus here, is a frequent difeafe, produced by a wide pelvis, and a relaxed state of the foft parts, particularly the os externum. It is either complete or incomplete. When it is without the external parts, it displays different shapes, forming either a large rounded mafs, or being narrow and elongated, fo as to extend fome way from the furface of the body. This appearance constitutes a fpecies of hermophroditifm. Where long inverted, the parts acquire a hardnefs, and inflammation and ulceration occafionally arife. Adhesion is also formed, while the uterus is in this prolapfed state, with the neighbouring parts, which

renders their reduction extremely difficult, and sometimes impossible.

Symptoms.

This complaint is marked by a sense of bearing down, and the passing up of a tumor through the vagina in the erect posture. Examination, however, is the surest test.

DCCCXCIV.
Deviations.

Three different deviations of the vagina from the natural dimensions, merit to be noticed.

1. The 1*st* is its shortness to half its natural length, which is the effect of malconformation, and is only known by examination.

2. The 2*d* is its extreme wideness, from the previous dilatation of polypi that have been removed; and,

3. The 3*d* is narrowness; which, in a morbid degree, is generally the effect of malconformation.

DCCCXCV.
Morbid Appearances of the External Parts.
Imperforated Hymen.

The conclusion of the vagina at its external extremity, is by means of a firm membrane, the effect of original formation, generally discovered at the period of menstruation, in consequence of the accumulation then taking place.

Symptoms.

Its symptoms consist in strong bearing down.

pain, first occurring at every menstrual period, and then departing; at last they become more continued as the accumulation, and of course the uterine irritation, increases.

DCCCXCVI.
Enlarged Clitoris.

This menstrosity is often at birth larger than the penis of a male child, with a prepuce glans, and an external fissure, so as to imitate the appearance of the male. In its progress, however, the increase is not equal to the increase of the penis. An accurate examination of the general state of the parts will detect the real nature of the malconformation.

DCCCXCVII.
Enlarged Nymphæ.

This enlargement sometimes occurs in one, and sometimes in both. When extended so as to pass beyond the labia, the structure becomes changed similar to that of the labia, and it is inconvenient from the effects of friction.

DCCCXCVIII.
Adhesion of the Labia.

The labia are found united in two ways, either by a fine line not extended to the meatus urinæ and glans of the clitoris, or they are joined by a continuation of the common skin, by which the labial appearance is lost. The parts here are the common seat of inflammation and ulceration from

a venereal caufe, but thefe merit no particular in-
veftigation.

DCCCXCIX.

MORBID CHANGES OF THE BRAIN AND ITS
MEMBRANES.

Inflammation of the Dura Mater.

The appearances exhibited by the dura mater
in a ftate of inflammation are, its increafed vaf-
cularity, though this never takes place in a high
degree from its natural ftructure; the lining of its
inner furface with coagulable lymph, which is not
frequent; and an adhefion between it and the
other membranes of the brain to a certain extent;
though this is alfo rare. Inflammation here often
terminates by fuppuration. Pus is found cover-
ing it, and even gangrene at times enfues. Ulce-
ration, alfo, is a frequent appearance.

Symptoms.

The marks of this morbid ftate are, pain of the
head, delirium, general fever, and fometimes con-
vulfions, or a tendency to thefe.

DCCCC.

Attachment of Extraneous Subftances.

The dura mater has at times tumors proceeding
from it of a fcrofulous or fpongy nature, the
former being diftinguifhed by the curdy pus on
diffection, the latter by their foft pulpy feel and
apparent fibrous texture. Even bony laminæ are
apt to form here, thin and irregular in their fhape,

of various fizes, and confined generally to the longitudinal finus or its falx, with a greater proportion of earth than common in their fubftance. The number of thefe offifications varies, and even the falx has affumed entirely this ftate.

Symptoms.

The fymptoms of tumor are marked by long-continued pain of the head, occafional delirium, or convulfions, not unfrequently apoplexy.

When bone forms the caufe, convulfions are more frequent, with continued pain of the head, and occafional delirium.

DCCCCI.
Adhefion.

Morbid adhefion is a frequent appearance here, and is probably the effect of previous inflammation. It prevails fo ftrongly as to divide the membrane on attempting to feparate it into two layers, one adhering to the cranium, the other to the pia mater.

Symptoms.

No peculiar fymptoms mark this.

DCCCCII.
Thicknefs of the Arachnoid Coat.

This is the only morbid appearance remarked here, and along with it a ferous fluid is found interpofed between it and the pia mater.

DCCCCIII.

Venous Turgidity of the Pia Mater.

This appearance occurs without marks of in-flammation, and is the confequence of the obftruc-tion of the blood in its paffage to the heart, fo that the veins here become diftended with de-oxydated or black blood.

Symptoms.

Stupor, delirium, and apoplexy, are the at-tendant fymptoms of this ftate.

DCCCCIV.

Inflammation of the Pia Mater.

Inflammation here is difficult to diftinguifh from the natural vafcular appearance of the mem-brane.   The chief diftinctions are drawn from the greater vafcularity of its under proceffes, and their clofer adhefion to the brain.   Occafionally the formation of pus takes place, effufed on its furface, and, more rarely, adhefion between it and the dura mater.

Symptoms.

The fymptoms are the fame here as inflamma-tion of the other membranes already noticed.

DCCCCV.

Anomalous Appearances of the Pia Mater.

This membrane is fubject to the attachment of fcrofulous tumors; to the diftenfion of its veffels with air, extricated in a peculiar manner from the circulation; to the adhefion of hydatids to its

fubſtance, and even to the occaſional converſion
of it into bone.

Symptoms.

None of theſe circumſtances have been charac-
terized by any peculiar ſymptoms.

DCCCCVI.

DISEASED APPEARANCES OF THE BRAIN.

The morbid appearances of the brain itſelf may
be reduced to real change of ſtructure, or fluid
accumulations.

DCCCCVII.

Inflammation.

The firſt of theſe changes is inflammation being
confined to a ſmall ſpot, either of it or of the
cerebellum, though this effect is rare without
external violence. It exhibits only increaſed vaſ-
cularity and redneſs, extending, if on the ſurface,
to the contiguous membranes.

Symptoms.

The ſymptoms of this ſtate are, pain of the head,
delirium, general fever, and coma.

DCCCCVIII.

Abſceſs.

Abſceſs of the brain is a frequent conſequence
of inflammation, by which its texture is broken
when the collection is great, or the part ulcerated
where it is ſmall.

Symptoms.

The marks of this ſtate are the ſymptoms of in-

fl immation, with paralyfis and convulfions, parti-
cularly where it is feated in the tuber annul.rc, or
medulla oblongata.

DCCCCIX.
Gangrene.

Gangrene here is rare, and exhibits a dark
brown appearance, with much foftnefs.

DCCCCX.
Softnefs.

Preternatural foftnefs of the brain is moft con-
fpicuous near the lateral ventricles in the medulla
of the hemifpheres. It attends fatuity in age, and
is combined with fanguineous apoplexy.

DCCCCXI.
Firmnefs.

The oppofite ftate of the former is more com-
mon, joined with toughnefs and elafticity to a
great degree; and here an enlargement of the
ventricles takes place, with an accumulation of
ferous fluid. Exceffive drynefs of the brain has
been alfo noticed, and lightnefs of the medullary
fubftance.

Symptoms.

Mania has been confidered as the leading mark
of this ftate.

DCCCCXII.
Preternatural Formation.

In the fubftance of the brain, a fmooth, uni-
form, firm, white fubftance is formed, to which

the brain adheres, with an increafed vafcularity of its edges. Similar rounded maffes appear in different parts of the brain, and in fuch cafes a ferous accumulation prevails in the lateral ventricles. This conftitutes fcrofula of the brain, the fubftances being occafionally converted into fcrofulous matter. Encyfted tumors are alfo at times an appearance in the brain, probably connected with the fame caufe. Bony tumors have been alfo noticed, confifting of an irregular mafs of offeous proceffes, filled up by a flefhy interftitial fubftance.

Symptoms.

The fymptoms of thefe various preternatural affections are, fixed pain or uneafinefs in the head, with occafional delirium, convulfions, and apoplexy. If paffing on to the optic thalami, defect of vifion is conjoined; if to the tuber annulare, or medulla oblongata, convulfion is the moft frequent fymptom.

DCCCCXIII.

Hydrocephalus, or Watery Accumulation.

Internal.

Perhaps the moft common difeafe of the brain is the hydrocephalus, where water is accumulated in its ventricles. It is a difeafe of childhood, from the moment of birth till near the age of puberty, though its attacks are confined to the three or four firft years of life. The quantity of accumulation varies in different cafes, from a few

ounces to as many pints. Where it is in excefs, by the raifing of the anterior end of the fornix, a communication comes to be formed between the lateral ventricles, and from the fame caufe alfo it extends into the 3*d* and 4*th*. The accumulation here confifts of ferum in a purer ftate than in the other cavities, though the proportion of its coagulable matter varies in different inftances. By much accumulation, the ftrueture of the brain is changed more or lefs into a pulpy mafs, or containing bag. The bones of the cranium fuffer an extenfion from this difeafe, altering, alfo, in fome degree, their fhape, and the fkull greatly exceeds its ufual proportion to the face. The futures, however, form the chief places of the extenfion of the cranial cavity; but the bones are alfo thinned, and their fibres diftraeted, which difplay membranous interftices. Such are the changes produced by long continuance of this difeafe.

Symptoms.

The fymptoms of this difeafe enumerated are, pain of the head, joined with ftupor and convulfions, occafional heetic, picking of the nofe, and grinding of the teeth; joined, when more advanced, with dilated pupils and fquinting. Sicknefs of the ftomach, and coftivenefs, commonly attend. The pulfe, at firft frequent and regular, becomes more flow and irregular as the difeafe proceeds to its laft ftage.

DCCCCXIV.
External.

The same accumulation has been known on the surface of the brain, confined by the pia mater. It is, however, rare, and perhaps rather conjoined with the former. It has been also known between the cranium and dura mater, and between the dura and pia mater; but these are rarely original states of disease.

DCCCCXV.
Bloody Accumulation.

The effusion of blood is common within many parts of the cranium. It depends generally on rupture; and this effusion may be lodged in the cerebral substance in the ventricles upon the surface of the brain, or within its membranes, according to the particular cause of the rupture.

Effusion here is either attended with a sound or diseased state of the vascular system of the head; and, in the first case, which is the least common, the effusion is the consequence of external violence. The diseased state consists in the large arterial branches of the head losing their power of contraction in consequence of taking on an osseous disposition, and this disposition they communicate to their smaller ramifications. The quantity effused varies, but is often considerable, and in a coagulated state, the pressure of which injures the organ. The seat of the effusion is oftenest the

medullary part of the hemifpheres, and near the lateral ventricles. A morbid foftnefs of the brain alfo may favour that effufion.

Symptoms.

The fymptoms of a membranous effufion are, coma in different degrees; thofe of an effufion into the cerebral fubftance are, alfo, ftertorous breathing, and pafy more or lefs complete, convulfions, with pulfe flow, full, and ftrong. If life continues, thefe fymptoms end in permanent hemiplegia.

DCCCCXVI.
Serous Accumulation.

This is generally confined to the medullary part of the hemifpheres, which becomes lined with a firm membrane containing it.

DCCCCXVII.
Aneurifm.

The only aneurifm within the brain is that of the internal carotid, at the fella turcica. It is connected with the difeafed ftate of the artery; in advanced life is very rare; and the tumor has been found the fize of a cherry.

DCCCCXVIII.
Morbid Change of the Choroid Plexus.

Diftenfion of the vein at its edge produces here the appearance of hydatids, in fize from a pea to that of a goofeberry. It is an appearance, however, very rare. Scrofulous tumors alfo, of a

fmall globular fhape, are found attached to this part, and are equally rare.

DCCCCXIX.

Difeafes of the Pineal Gland.

The pineal gland is fubject to various morbid changes.   A depofition of earth is found conftantly in its fubftance, in a greater or lefs quantity ; and a fmall portion appears without difeafe.   It is alfo fubject to fchirrus, acquiring a greater firmnefs than is natural ; and water has even been found to diftend its fubftance.

DCCCCXX.

Difeafes of the Pituitary Gland.

This gland has been found enlarged and changed into a fomewhat firm fibrous texture.

DCCCCXXI.

Difeafed Nerves.

Nerves are feldom found difeafed.   Where they are, they fhrink in fize, become fofter than natural, and lefs opake in colour.   In their original ftructure, however, they vary in different cafes in their fize.

DCCCCXXIII.

Malconformation of the Brain.

A confiderable variety of malconformation in the origin of the nervous fyftem is met with. Often moft of the cerebrum is wanting, while the cerebellum and fpinal marrow are entire.   Somecs there is little appearance of either of thefe,

with the medulla spinalis at the same time of a small size, while the nerves in general are of their proper form and size. Where the brain is wanting, the cranium is on a level with the eyes, and has its scalp covered with a soft spongy excrescence, divisible into distinct cellular masses, and having a fine vascular covering over it. Instead of this excrescence, there often appears a considerable bag descending from the scalp over the back of the trunk, containing a serous fluid, and at times portions of brain, having a communication with the cranium.

DCCCCXXIII.

Morbid State of the Cranial Bones.

A general diseased thickening of the whole cranial bones has at times occurred, so as to press upon the cavity of the brain; and with this thickness they acquire, at the same time, a spongy texture. A partial growth has also been noticed, or an ivory-like needle protruding into the cranial cavity, forming a permanent cause of compression upon the brain. The natural irregularity of the inner surface of the cranial base, consisting in its ridges lengthening and forming sharp spaculi, is a frequent source of irritation of the nervous system.

DCCCCXXIV.

Forms of Injections used for Anatomical Preparations adapted to the different Kinds of Preparations commonly made.

1. In forming coloured injections, it is neceſſary, in order to their uſe, that they ſhould be liquified by a degree of heat leſs than that of the boiling point, that the texture of the veſſels to be filled may not be deſtroyed; and next, that it ſhould remain ſomewhat ſolid, or rather ductile, when introduced; and again brought to the ordinary temperature. The only exception to this rule is in the corroded preparations, when the greateſt degree of ſolidity in the injection is required.

2. Anatomical injections are of four kinds; *Coarſe, Fine, Minute,* and *Mercurial.*

Coarſe Injections.

The coarſe is commonly employed for entire ſubjects or extremities, or for large veſſels, where no minute parts are to be filled. It may be variouſly coloured; and its ingredients conſiſt of the following proportions:

FORMS.

Red.

Yellow bees wax, 16 ounces;
White reſin, 8 ounces;
Turpentine varniſh, 6 ounces;
Vermilion, 3 ounces.

The three firſt ingredients are to be liquified over a ſlow fire, and the vermilion afterwards added by mixing it firſt with a little of the liquified compoſition, and ſtirring it well with a wooden peſtle. The whole of the ingredients being then blended together and heated, the injection will be fit for uſe.

Yellow.

Yellow bees wax, 16 ounces ;
White refin, 8 ounces ;
Turpentine varnifh, 6 ounces ;
King's yellow, 2½ ounces.

White.

Fine bees wax, 16 ounces ;
White refin, 8 ounces ;
Turpentine varnifh, 6 ounces ;
Flake-white, 5½ ounces.

Pale Blue.

White bees wax, 16 ounces;
White refin, 8 ounces;
Turpentine varnifh, 6 ounces;
Beft flake-white, 3½ ounces;
Fine blue fmalt, 3½ ounces.

Dark Blue.

White bees wax, 16 ounces ;
White refin, 8 ounces;
Turpentine varnifh, 6 ounces ;
Blue verditer, 10½ ounces.

Black.

Yellow bees wax, 16 ounces ;
White refin, 8 ounces ;
Turpentine varnifh, 6 ounces ;
Lamp black, 1 ounce.

Green.

Yellow bees wax, 16 ounces ;
White refin, 8 ounces ;
Turpentine varnifh, 6 ounces ;

Chryftallized verdigrife, 4¼ ounces;
Beft flake-white, 1½ ounce.
Gamboge, 1 ounce.

Fine Injections.

The fecond kind of injection, or the fine, is appro-
priated for filling the fmaller branches of the principal
veffels, part of which being firft thrown in, is fuc-
ceeded by the coarfe, to force it on and fill the minute
parts.   The forms of fine injection are:

FORMS.

Red.

Brown fpirit varnifh,
White fpirit varnifh, of each 4 ounces;
Turpentine varnifh, 1 ounce;
Vermilion, 1 ounce.

Yellow.

Brown fpirit varnifh,
White fpirit varnifh, of each 4 ounces;
Turpentine varnifh, 1 ounce;
King's yellow, 1¼ ounce.

White.

Brown fpirit varnifh,
White fpirit varnifh, of each 4 ounces;
Turpentine varnifh, 1 ounce;
Beft flake-white, 2 ounces.

Light Blue.

Brown fpirit varnifh,
White fpirit varnifh, of each 4 ounces;
Turpentine varnifh, 1 ounce;
Fine blue fmalt, 1½ ounce;
Beft flake-white, 1¼ ounce.

Dark Blue.

Brown fpirit varnifh,
White fpirit varnifh, of each 4 ounces;
Turpentine varnifh, 1 ounce;
Blue verditer, 4 ounces.

Black.

Brown fpirit varnifh,
White fpirit varnifh, of each 4 ounces;
Turpentine varnifh, 1 ounce;
Lamp-black, $\frac{1}{2}$ ounce.

When the coarfe and fine injections lofe part of their fluidity by frequent melting, a little more of the turpentine varnifh is to be added to the mafs, and the quantity may be judged of by its ductility.

Minute Injections.

The third kind, or minute injections, is adapted folely to the fmaller ramifications of the veffels; and the fize being the chief part of the receipt, is thus prepared:

Take the fineft glue or ifinglafs, one pound; break the glue into fmall pieces, and putting them into an earthen pot, pour on them three pints of cold water: when it has ftood 24 hours, occafionally ftirring it, it is to be placed on a flow fire till diffolved, which generally requires half an hour. When removed, and fkimmed from its froth, and paffed through a fine cloth of canvas or flannel, it is then fit for the additional ingredients.

Forms.

Red.

Size, 1 pint;
Vermilion, $3\frac{1}{2}$ ounces;

Yellow.

Size, 1 pint;
King's yellow, $2\frac{1}{4}$ ounces.

White.

Size, 1 pint;
Beft flake-white, $3\frac{1}{2}$ ounces.

Blue.

Size, 1 pint;
Fine blue fmalt, 6 ounces.

Green.

Size, 1 pint;
Chryftallized verdigrife, 2 ounces;
Beft flake-white,
Gamboge, of each eight fcruples.

Black.

Size, 1 pint;
Lamp black, 1 ounce;
Thefe injections do not keep unlefs they are dried.

The fourth kind of injection, or quickfilver, requires no particular preparation, but much nicety and caution in conducting the operation with it in order to be fucefsful.

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